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ABSTRACT

This document, which was developed after a comprehensive review of the current state of driver education across the United States and which included an extensive literature review and interviews with 40 individuals from various sectors, including education, law enforcement, and the insurance industry, identifies ways of revamping driver education. Discussed in the introduction are the current state of knowledge and the need to rethink the objectives and methods of driver education. The following aspects of developing a curriculum outline strategy are considered: driver education's missions, stakeholder needs, underlying strategic assumptions, and curriculum development goals. Presented next is an outline listing 40 performance objectives in the following categories: motivation, knowledge, attention, detection, perception, evaluation, decision, motor skills, safety margin, and responsibility. The following topics are examined in a section on methods: shaping methods to goals, building instructional media units, instructional delivery, refocusing driver education resources on motivation, educating motivation and responsibility, planning and evaluation, and curriculum integration. Included in a section on supporting noninstructional influences are suggestions for coordinating community influences and linking driver education with graduated licensing. Concluding the document are a summary, and 10 recommendations for revamping driver education. Appended are a methods outline and list of the 40 experts consulted. Contains 136 references. (MN)

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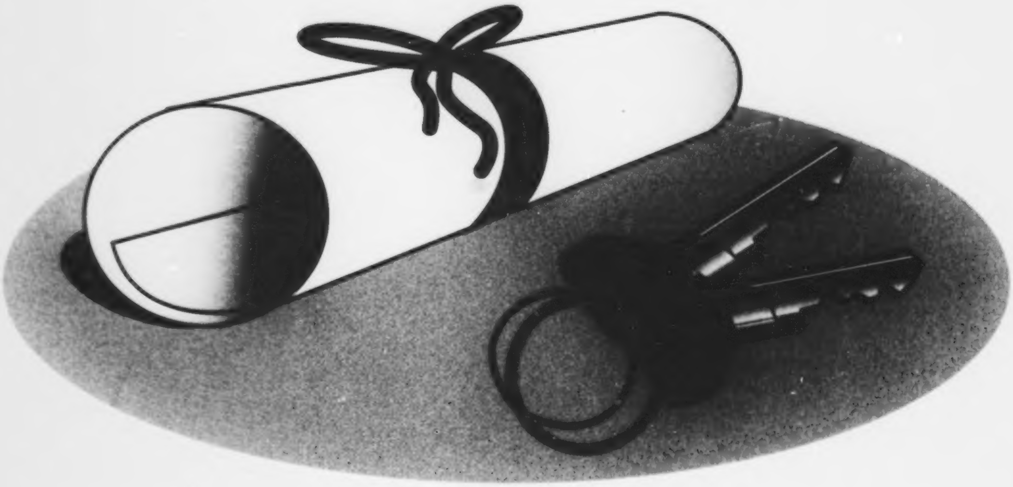
NOVICE DRIVER EDUCATION MODEL CURRICULUM OUTLINE



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Prepared for

AAA Foundation for Traffic Safety

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EXECUTIVE SUMMARY AND RECOMMENDATIONS

THE STATE OF DRIVER EDUCATION

The AAA Foundation for Traffic Safety has sponsored a project to "reinvent" driver education into a form that reduces crashes by novice drivers. The research team reviewed the current driver education literature in order to identify novice driver needs, evaluate methods of instruction, and assess the effectiveness of driver education in influencing behavior. The researchers then proposed performance objectives for driver education graduates and methods for achieving those objectives.

The main function of current driver education is to support mobility. New drivers need a certain level of skill in order to pass a state or provincial licensing test and satisfy the concerns of their parents or guardians. Driver education helps meet this need. However, the additional need exists to improve the safety performance of novice drivers. When a large-scale study in DeKalb County, Georgia, failed to show a net safety benefit, driver education lost much government support. Although some jurisdictions and suppliers of curriculum materials have continued to develop their programs, in overall terms driver education has declined in the last 15 years.

This paper identifies ways to restructure driver education to realize its potential for improving safety.

This paper identifies ways to restructure driver education to realize its potential for improving safety. This new driver education must operate, at least initially, within current resource limitations. It must be modular and flexible to accommodate different programs and a variety of scales, standards, and resources in different jurisdictions. To be widely accepted, curriculum materials should be packaged for easy and straightforward delivery in poorly capitalized, low-tech instructional environments.

THE NEEDS OF NOVICE DRIVERS

Novice drivers experience serious crash losses far beyond their representation in the driver population or their proportion of mileage driven. As a group they take between five and seven years to reach mature risk levels. However, they vary widely in cultural background, life situation, skills, ability, motivation, level of experience, and crash risk. The difference between male and female behaviors and risks are the best known (although sex differences seem to be diminishing).

…the "baby boom echo" …may contribute to increased young driver fatalities in the later 1990s.

The number of novice drivers has been declining for many years, and this has reduced new driver losses. However, this trend will reverse over the rest of the decade as the "baby boom echo" reaches driving age. In addition, economic recession reduces the number of young driver fatalities, so economic recovery may contribute to increased young driver fatalities in the later 1990s. Over the next few years the problem of novice drivers of all ages will take on greater importance.

NOVICE DRIVER SKILLS AND ABILITIES

New drivers lack important skills, particularly those needed to acquire and process information. They are less able to maintain full attention and less likely to take in the information they need from the driving environment. They are not as good as experienced drivers in scanning the environment, recognizing potential hazards while they are still at a safe distance, and making tough decisions quickly. They tend to underestimate the danger of certain risky situations and overestimate the danger in others.

Improved skills alone are not sufficient to ensure new driver safety, however. The safety effects of good driving skills appear to be offset by overconfidence and increased exposure to risk. Better-trained novice drivers become licensed sooner and drive more, in part because of their own increased confidence, but also because their parents often give them more freedom to drive.

NOVICE DRIVERS' CHOICES AND BEHAVIOR

Crashes are caused by what drivers choose to do as much as by what they are able (or unable) to do. Most of novice drivers' increased risk comes from inappropriate behavior — deliberately taking risky actions, seeking stimulation, driving at high speeds, and driving while impaired. Compared to more experienced drivers, novice drivers more often choose to drive too fast and follow other vehicles too closely. They run yellow lights more, accept smaller gaps in traffic, and allow less room for safety. As a result of their choices, and perhaps because of skill deficiencies as well, they have more rear-end crashes and run-off-the-road crashes than experienced drivers.

HAZARD PERCEPTION, RISK EVALUATION, AND RISK ACCEPTANCE

What drivers are able to do and what they choose to do are two different things. Knowledge of how to control a car is not as critical to safety as individual motivation: Strong motivation makes up for weak skills better than strong skills make up for weak motivation. Without strong motivation to reduce risk, advanced skills training can lead to more crashes, not fewer.

Strong motivation makes up for weak skills better than strong skills make up for weak motivation.

Risk acceptance is not the same thing as crash acceptance. Few drivers will take a risky action if they know it will result in a crash. Instead, risky choices result from poor risk perception and inability to detect hazards, often coupled with overconfidence. Good risk detection, good risk evaluation, and strong motivation may support each other. However, if driver education is to produce safer drivers it must reinforce the individual and community factors that positively influence personal motivation and social responsibility.

PARENTS/GUARDIANS AND NOVICE DRIVERS

Parents may inadvertently contribute to the failure of driver education to produce safe drivers. They appear to allow driver education graduates more freedom and offer less supervision, exposing new drivers to increased risk. Thus, driver education needs to involve family intervention and must take advantage of the family's strengths in influencing early driving behavior. Parents and guardians need to take a more active and effective role as their children learn to drive. A major challenge for driver education is to discover how to motivate parents to become more realistic about their children's driving, and about the limitations of driver education courses, without turning them off to formal training.

INTEGRATING COMPLEMENTARY SKILLS AND VALUES

Many different educational fields teach skills, knowledge, and values that are desirable in novice drivers. Driver education objectives are already integrated into other school subjects, such as physics, mathematics, and social studies. New media and teaching techniques can expand the range of this integration. Use of interactive media can enhance attention, improve perception, and hone the decisionmaking skills that apply to many tasks besides driving.

The most critical areas of integration are personal and social values, risk-taking, self esteem, feelings of power, sense of community, and interest in health. These feelings motivate pro-social and self-protective behavior. Participation in peer group learning activities can help integrate safety-promoting values into all areas of students' lives.

DEVELOPING SUPPORTING INFLUENCES FOR NOVICE DRIVERS

Most new drivers' motivation and responsibility can be enhanced by a sufficiently intense program of education. Peer influences, community education programs, and incentives can all affect novice drivers' behavior. Some new drivers display deviant and problem behaviors; they are likely to be at the highest risk. Community resources must address the special needs of these multi-problem youngsters.

> ***A major challenge for driver education is to discover how to motivate parents to become more realistic about their children's driving...***

To develop community resources, the driver education industry, school authorities, insurers, governments, families, and communities must decide that they care enough about driver safety to coordinate their efforts. This will require many organizations to cooperate and change.

GRADUATED LICENSING

Graduated and provisional licensing systems are likely to be implemented soon in a number of North American jurisdictions. To make such programs effective over the long term, they must be coordinated with driver education. This raises questions of how to organize driver education programs to support new drivers' learning and performance in different graduated licensing systems.

STRATEGIC DIRECTIONS

Demographic and economic trends will lead to an increased market demand for driver education in the coming years. The number of young people is increasing (as are health care costs), and the number and cost of crashes will almost certainly increase concomitantly. With a new, more effective driver education curriculum, issues of standards, governance, and teacher and instructor training will become more important. In addition, the trend towards privatization of driver education will produce new business opportunities for driving schools, suppliers of instructional materials, and instructor trainers. Standards for the compatibility of hardware and software will be needed as technology develops and driver education becomes more complex.

Effective new driver education will be adaptive and experimental. It will stimulate and incorporate rapid advances in knowledge and technology. It will also benefit greatly from advances in interactive learning technology.

Realistic, interactive simulators of the whole driving task are not yet a reality. However, interactive multimedia units and partial task simulators will be readily available soon. These are the relatively easy parts of the reinvention of driver education, and they will free up resources to concentrate on teaching the "hard parts."

The hard parts include:

(1) Devising an effective means of influencing motivation and responsibility;

(2) training and supporting the teachers needed to deliver part 1; and

(3) mobilizing family, community, industry, and government resources to add weight to the influence of parts 1 and 2.

It is unlikely that the necessary coordination will be achieved on a large scale. It may be possible within communities or private, voluntary associations, such as auto club members or groups of insurance company clients.

The new driver education will not be the result of a single, top-down development exercise, nor will there be a single, monolithic curriculum. It will develop in a pluralistic and competitive way, although governments may need to expand their role by setting standards and coordinating efforts. It will include families, communities, and youth groups as well as schools.

The driver education industry must lead the educational and organizational change that is needed if driver education is to become an effective safety intervention.

RECOMMENDATIONS

1. Develop software for teaching and testing knowledge and skills in an individual, self-paced, automated way.
2. Develop interactive multi-media units for training and testing driver attention and visual detection as well as risk perception and evaluation.
3. Develop software based on game-theory models to diagnose, clarify, and reinforce modification of new drivers' risk-taking styles and to demonstrate their consequences.
4. Develop improved in-car instruction and instrumentation to teach driving and perception skills and provide feedback on driver performance.
5. Develop participative classroom units for peer-focused seminars, individual study projects, and group work. These are needed to clarify health and safety values and to enhance personal motivation and social responsibility.
6. Develop instructor training to support the use of new interactive media, participative classroom units, and in-car perception units. The need is to reinvent the teacher and instructor's role, enriching the job by shifting the emphasis from information provider to that of coach or mentor for health and safety motivation, social values, and life skills.
7. Develop tools, models, and instruction units that support parent involvement in young driver education.
8. Develop models and incentives that mobilize community, industry, and government support for coordinating positive influences on novice drivers. These should include links between the driver education and health promotion communities and between driver education and insurance providers.
9. Coordinate development of graduated licensing systems with driver education. Move to multi-stage education in the graduated licensing jurisdictions. These driver education formats should also be pilot tested for effectiveness and market acceptance in non-graduated jurisdictions.
10. Expand the integration of driver education topics into other school subjects, particularly health, community service, and other values-related activities.

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1. INTRODUCTION

1.1 CURRENT STATE OF KNOWLEDGE IN DRIVER EDUCATION AND TRAINING

The purpose of the project leading to this report was to "reinvent" driver education (DE). The strategy was to attempt to initiate a broad program development effort to develop a more intensive and comprehensive form of driver education, which can lead to crash reduction for novice drivers. The project team reviewed a wide range of research and development literature and interviewed numerous researchers, administrators, and practitioners with interests in DE. The team identified state-of-the-art of knowledge in a number of areas: driver education effectiveness, novice drivers' needs, and methods of instruction and influence. This knowledge was synthesized to establish performance objectives for DE graduates, as well as instructional methods and program development strategies for achieving these objectives.

At the outset of this investigation it became clear that injuries on the roads are a major contributor to disability and premature loss of life, and to escalating costs for health care and social services. Health and safety education and other behavioral health promotion interventions are taking on greater importance. In an increasingly complex world, more effective learning is central to safer behavior. Safety education could, in principle, direct and facilitate this learning. James Malfetti suggested that safety education is crucial to living in a technological world. He wrote,

> *Man can no longer rely on his instinct of self protection to live safely among the great hazards produced by technological advances. He must learn new safety skills and new behavior patterns. How well he learns them depends considerably on the effectiveness of safety communications (Malfetti, 1986 p.1).*

Young, novice drivers are greatly overrepresented in crashes (*e.g.*, Evans, 1987; Gebers *et al.*, 1993; NHTSA, 1994; TIRF, 1991). Wilde (1994b) pointed out: 1) that the overrepresentation of novice drivers is an international phenomenon, although it varies in size from country to country and from time to time; 2) that it holds true both per mile driven and per person; and 3) that the overrepresentation is due to two different factors, immaturity and inexperience.

The safety purpose of driver education (DE) seems to be to eliminate the excess risk of novices during their first few years of driving – to help them perform as safely as they will when they become more mature and experienced. We might logically task DE with producing better drivers later in life, since most novice drivers will "outgrow" their early risky driving eventually, if they survive intact. Learning always involves making mistakes and correcting them. Experience in the roadway system eventually teaches novices to stop making immature mistakes. As Fuller (1988, 1990) points out, it also teaches them to make other mistakes. While the novice driver crash problem remains excessive, novice driver problems seem likely to remain DE's main focus. Waller (1983) wrote, "the question for driver preparation is whether the careful programming of clearly identified key events could improve upon experience as a teacher" (p.9).

Formal driver education has been under attack for its apparent inability to produce beginner drivers who crash less than those who are less formally trained, by friends or relatives. However, it has been popular, because of convenience and relevance to mobility needs. It also has "face validity" for safety – parents apparently think it makes their children safer drivers (*e.g.*, Plato and Rasp, 1983). It has also become a major industry. DE markets are supported by insurance premium discounts and licensing

...more effective learning is central to safer behavior.

Experience in the roadway system eventually teaches novices to stop making immature mistakes.

provisions, but there is wide variation across different jurisdictions, even in North America. In the U.S., "market penetration" apparently peaked in the early 1980s at about 80% of new drivers being formally trained.

Since the early 1980s, however, many high school DE programs have been dropped. For instance, New Jersey schools offering DE dropped from 96% to 40% between 1976 and 1986 (TIRF, 1991). The time seems right for change and renewal (*e.g.*, TAC/CCMTA, 1994). The U.S. National Highway Transportation Safety Administration (NHTSA) has recently issued a research agenda for work on driver education and graduated/provisional licensing (GPL) (NHTSA, 1994). While all serious crashes decline in periods of economic recession, young driver casualties decline even more. Economic recovery, and an increasing number of new drivers (the "baby-boom echo") may lead to increased concern with novice driver safety later in the decade. The purpose of the current project is to initiate an ongoing program development process to reinvent driver education. The principal product is a draft curriculum outline, intended to lead to a more intensive and comprehensive form of driver education for the 21st century.

The balance of this introductory section contains a summary review of knowledge of driver education's effectiveness and critical aspects of driver characteristics and driving tasks. Section 2 describes the curriculum outline strategy, addressing stakeholder needs and DE's mission and goals. Section 3 presents the curriculum outline structure, addressing a logical framework, the desired educable qualities of the well-educated novice driver, and performance objectives. Section 4 addresses instructional methods and activities, relating them to performance objectives. Section 5 investigates possibilities for curriculum integration and synergy between driver education and other educational fields. Section 6 broadens the range of influences on driver performance, exploring potential linkages between DE and other, mainly non-instructional behavioral influences. Section 7 addresses the need to harmonize DE programs with graduated and provisional licensing systems (GPLs). Section 8 provides a summary and outlines conclusions and recommendations for further work.

Driver Education Effectiveness

The DeKalb County Driver Education Project is the most comprehensive experiment in beginner driver education. It is best known for its impressive efforts to provide improved training and well-controlled evaluation (Ray *et al.*, 1980; Smith, 1987; Stock *et al.*, 1983). It has been seen as a "crucial experiment" to show whether a state-of-the-art program could reduce collisions. Disappointment with the results of this experiment appears to have played an important role in the decline of support for driver education, particularly in the U.S. The likelihood of this outcome was pointed out by Waller (1983) before the final results were known. She expressed reservations about whether such an expensive program could be widely implemented even if successful and also wrote, "What is perhaps more unfortunate is that any negative findings are likely to be used as a basis for dismissing driver education out of hand and refusing to continue funding in this important area" (p.7). The *Safe Performance Curriculum* (SPC), used as the intensive training treatment in the DeKalb experiment, was developed from the extensive driver task analysis of McKnight and colleagues (1971). This approach was criticized by Waller (1983) as not being adequately based on empirical data, which was then not available, and still is limited.

In the DeKalb experiment, students were assigned randomly to either an improved curriculum (the *Safe Performance Curriculum – SPC*), a minimal curriculum (PDL), or no training. The SPC was more intensive than usual DE programs, consisting of 32 hours of classroom instruction, 16 hours of simulation instruction, 16 hours of driving range instruction, 3 hours of collision evasion instruction, and

3.3 hours of on-road, behind-the-wheel instruction, including 20 minutes at night (Lund *et al.*, 1986). The short on-road instruction has been criticized, being even less than the six to 10 hours commonly used in current programs.

SPC-trained drivers showed better on-road skills and collisions per licensed driver over their first six months of driving. However, the reduction of collisions and violations per licensed driver was partially offset by earlier licensing of the SPC-trained drivers. After six months, collisions per driver were no longer different between the groups. Wilde (1994b) suggested that the better-trained SPC students became overconfident and that this offset the potential benefits of their superior skill and knowledge. In a follow-up study of the records of the DeKalb students over six years, it was found that both the SPC and minimal curriculum *males* had significantly fewer convictions, and both males and females in the minimal curriculum group had fewer crashes (6%) than the untrained controls (Weaver 1987).

Lund *et al.* (1986) reanalysed the DeKalb data and compared the results for the total numbers of students assigned to each group, not just those who became licensed. They found that students who were assigned to the improved driver education curriculum were significantly more likely to obtain drivers' licenses, be in collisions, and have traffic violations. In comparison, students taking the "minimal" PDL curriculum, though also more likely to become licensed, were not significantly more likely to be in collisions or to have violations. Lund *et al.* suggested that the lower skills of the minimal curriculum students led to slower licensing and more caution in driving after they were licensed. They suggested peer modelling as an explanation for the increase in early licensing among the trained students. Lund *et al.* contended that until future research identifies more effective programs, driver education should be seen as a method to teach basic driving skills only, not as a strategy for reducing collisions.

More disturbing than lack of evidence for positive effects of DE is the contention that it causes harm by inducing increased exposure to risk. DE may encourage young people to start driving, and consequently crashing, at earlier ages than they would have in the absence of training. Robertson (1980) investigated the results of the elimination of Connecticut state subsidies for driver education in high schools. Nine school boards decided to drop the courses from the curriculum, while other communities continued to offer them. Obtaining a driver's license became more difficult and expensive in the areas that dropped the DE course. Robertson reported that the number of licensed years of 16- and 17-year-old DE graduates declined by 57% in the affected communities, as compared with 9% in communities where DE was retained. The affected communities showed a 63% decrease in the collisions of 16- and 17-year old *DE graduates*, while there was no change in the other communities. With DE no longer available in these communities, major declines in licensing and crashes by DE graduates are not surprising. The decline in total licensing and crashes of all 16- to17-year-olds in the affected communities was much less (10-15%). Most young people apparently found other ways to learn to drive. While the well-known Connecticut data do not strongly support Robertson's conclusions, other studies (*e.g.*, Wynne-Jones and Hurst, 1984) have shown effects of DE on licensing among 16- and 17-year-olds, although the effect is probably less dramatic than Robertson seemed to suggest.

Driver education may encourage young people to start driving, and consequently crashing, at earlier ages than they would have in the absence of training.

Smith (1983) suggested that the wrong criteria were used in the evaluation of the DeKalb Project and most other driver education evaluations. He seems to view the issue more as one of specific training effectiveness and less as one of engineering safety on a broad societal scale. He contended that collision measures are not the appropriate criteria to assess a program whose main objective is to ensure proper and safe driving performance. Smith recommended the adoption of an intermediate criterion developed for the improved curriculum of the DeKalb project. This measure is based on observed behavior in selected traffic situations. In addressing the question of the proper goals against which to evaluate driver education, Waller had earlier written,

> *To hold driver education instructors responsible for the subsequent driver records of students is a little like holding home economics teachers responsible for whether the students prepare well balanced meals two years later... math teachers would be judged according to how well students balance their checkbooks in later years....I would maintain that in driver education we should be able to hold the instructor responsible for how well the student is able to operate the vehicle and how well he knows the rules of the road. However, whether he actually uses the skill and knowledge he has acquired depends on may things beyond the control of the driver education instructor. It is utterly foolish to expect a teacher to change the attitudes of students in 36 hours of contact (Waller, 1975, p.17-18).*

Proper expectations and goals for DE continue to be controversial, and they will be discussed further in Section 2. The finding that a particular DE program fails to improve safety does not mean that training or education *cannot* produce a lasting safety effect. Most people do eventually learn to drive reasonably safely. Some combination of experiences and influences eventually brings drivers to a mature, though perhaps imperfect, level of risk. The SPC and the best current curricula can improve some of the initial skills and performance of their students. It is likely that some level of training, better, longer, or differently focused, or some combination of training and other influences, would improve ultimate safety performance.

The finding that a particular driver education program fails to improve safety does not mean that training or education* cannot *produce a lasting safety effect.

In DE, as in many aspects of safety education, we seem to expect massive effects from what is in reality a rather minimal effort. Current DE curricula, and even the more extensive SPC, represent little instructional time relative to the learning that takes place after a driver is licensed. The SPC in particular had a very low amount of on-road driving instruction. It is not surprising that the DE experience is overshadowed by later experience, and offset by overconfidence, by increased mobility and exposure to risk, and perhaps by relaxed parental supervision. These offsetting factors need to be considered in any future DE curriculum.

It is not clear to what extent differences in the amount or type of driving exposure, or differences in the amount of parental supervision contribute young drivers' risk, but there is good reason for concern. Preston (1980) found that parents of children trained to cycle more skillfully gave the better-trained and more-highly-skilled students more freedom to cycle when and as they chose. An analogous relaxing of parental vigilance has been observed in children's accidental poisonings by analgesic medications after introduction of "child-proof caps" for containers (Viscusi, 1987). For teenagers, a similar effect could contribute to a substantial difference in exposure to risk, and perhaps even to earlier licensing of new drivers whose parents consider them well-trained and therefore safer (*e.g.*, Waller, 1983).

It is possible that parents give better-trained students more freedom to drive when and as they choose, leading perhaps to more exposure to more severe risks. Parents do seem to show confidence in the ability of DE to teach their youngsters to drive safely (*e.g.*, Plato and Rasp, 1983). If DE leads parents of new drivers to believe they can relax their supervisory duties, and if a better program lets them relax more, this could help defeat the safety effects of even improved programs. Parents' overconfidence in novice drivers' skills and motives is dangerous. A much stronger parent education component will be needed in a new and more effective DE program, and especially for an effective graduated licensing program. Parents need to be educated as to the limitations of driver education and skills testing, without alarming them or "turning them off" these programs. They need to have a realistic view of their key role, primarily as a supervisor of progressive responsibility of their novice drivers.

Parents' overconfidence in novice drivers' skills and motives is dangerous.

Other Effectiveness Evaluation Studies

Methodological difficulties, biases, and the rarity of collisions have plagued DE efforts (Wynne-Jones and Hurst, 1984). An evaluation of the Automobile Association (AA) driver training program in New Zealand used an experimental design with random assignment to eliminate self-selection bias. No statistically significant reductions in collisions or convictions were found for AA students. Females in the trained group reported significantly more collisions than those in the control group. This study again found that students obtained their licenses earlier. This suggests that DE may be seen as having mobility benefits, or mobility-based safety benefits, as opposed to net safety benefits over the whole teenage population of drivers and potential drivers. It also could suggest that there should be some effort to restrict mobility in conjunction with training and maturation of new drivers, perhaps by graduated or staged licensing. The induced exposure effect seems clearest in the youngest drivers, and it may be limited to them. A more gradual introduction of the better-trained novices would result from a graduated licensing system, and this may reduce the induced exposure to more risk that usually seems to occur with increased or improved training.

Potvin *et al.* (1988) evaluated the impact of the 1983 mandatory driver training law in Quebec with a time-series study. This study used collision and license data for a five-year period to determine the impact of mandating driver training for all newly-licensed drivers on collision incidence and outcome. The effects were observed on 18-25 year old drivers, who were compared to 16- to 17-year-olds, who had been under a mandatory training requirement since 1976. It was estimated that 60% to 70% of 18-25 year olds had received training prior to 1983. All new drivers, including the comparison group, experienced more collisions after 1983, for apparently unknown reasons. The main effect of the program was an increase in the number of 16- to17-year-old females who became licensed. Thus the mandatory training law led to an increase in exposure and collision risk for young female drivers. The authors theorize that the increase in early licensure occurred because there was no longer any economic advantage to waiting until age 18 to be licensed. The effect was stronger in females, because few males had waited before 1983. The authors contend that, without viable alternatives, public and political support for driver training will undoubtedly remain strong in Quebec despite the substantial cost of the mandatory program. A public opinion survey a year after the mandatory training requirement was enacted showed that 80% of the Quebec public favored it.

1.2 RETHINKING DRIVER EDUCATION OBJECTIVES AND METHODS

Abilities vs Motives

What we decide to teach in DE depends heavily dependent on our views, either explicit or implicit, of what is critical about drivers, and what deficiencies are the ones most needing correction. Bower (1991) characterized two principal approaches to understanding the driver. The first is the "human factors" approach, which sees the driver as an information processor. In this view, the driver is adequately motivated to avoid crashes; mishaps occur due to failures in their perception or judgment skills to cope with a given situation. As a classical expression of this view, Svenson (1978) wrote,

> *Risk stems from the fact that drivers have to conduct their vehicles in situations producing an overload of their information processing and motor capacity, either because of difficult external conditions (e.g. darkness) or because of deteriorated functioning. (p.267).*

The second approach identified by Bower is "to view the driver as a bundle of motivations" (p.10). The motivational perspective is expressed by Fuller (1984):

> *For most of the time on the road it is the driver's own actions which determine the difficulty of his task. Driving is essentially a self-paced activity. Because of this it may be argued that the driver's motivation is at least as important, if not more so, than limitations of his perceptual-motor capabilities in contributing to the safety of his performance (p.1139).*

What we decide to teach in driver education depends heavily on our views, either explicit or implicit, of what is critical about drivers…

Errors

Reason (1990) has developed an extensive study of human error, based largely on the accident experiences of continuous-process industries, such as nuclear power and commercial aviation. Errors are defined as failure of planned actions to achieve the intended result, and they can be of two types: 1) mistakes, that is, the intention was not appropriate; and 2) lapses, that is, the action performed was not the one that was intended. Reason *et al.* (1990) have used the error model as a base for survey research on drivers' errors and violations. Among other findings, men of all ages reported more mistakes and women more lapses. The error analysis approach of Reason (1990), Rasmussen (1987), and others is helpful for understanding driver failures, since it focuses specifically on critical, accident-producing actions and their human causes, and motivations as well as skills or abilities.

Sources of Information on DE Targets

While we have relatively little precise data on drivers errors in general, we have still less on the specifics of novice drivers' critical deficiencies. It is not necessarily easy to choose the right driver behaviors or characteristics as targets for change, given the limitations of theory and data in road safety. There is limited information on the details of behavioral causes of collisions. While there is no one definitive source of data on what drivers do to produce collisions, there are a number of sources that can provide partial answers.

Expert Opinion

One such source is the opinion of knowledgable experts as to what behaviors and behavioral antecedents are most critical to the production and avoidance of collisions. In the absence of strong empirical data, this has been the dominant traditional approach. While we are not in a position to reject this approach, we should try to inform it with empirical support wherever possible. Waller (1983) wrote, "...until there is a careful empirical analysis of the driving task, our programs will continue to be based on nothing more than the collective judgment of 'experts' in the field, which is often no more than pooled ignorance" (p.10). While the systematic research envisioned by Waller has not taken place, we do have the advantage of more data on critical driver deficiencies than was available in the early 80s.

Unsafe Driving Acts (UDAs)

In seeking empirical data, we can look to various listings of driver behaviors or characteristics that appear in collision studies or other research, such as that investigating differences between novice and experienced drivers. As a start in identifying critical behaviors of drivers in general, Streff (1991) extracted the "unsafe driving acts" (UDAs) recorded as contributing to 1.5 million police-investigated crashes in 11 states. While sensitive to the severe limitations of the police report data, Streff found violation of right of way, speeding, and following too close as the top three UDAs. Unfortunately, some commonly reported UDAs are not actions but conditions, such as alcohol/drugs. Others, such as careless driving and inattention are imprecise legislative categories that could contain many specific behaviors. In preparing background for AAA Michigan's recent report *Portrait of a Young Driver* (1994), Streff investigated Michigan collision data for precrash hazardous actions by young drivers (15 to 18 years old). The actions identified, in order of prevalence, were: 1) following too closely; 2) failure to yield; 3) speed too fast; 4) improper lane use; 5) improper turn; and 6) improper backing/start. The prevalence of these actions declined over individual years, and the hazardous action category "None" increased. In fatal crashes, the order of the categories was: 1) speed too fast; 2) failure to yield; 3) following too closely; and 4) improper lane use.

...data from Indiana collision investigations indicate the importance of attention and environmental scanning behavior in crash causation...

Also addressing collision-causing actions of drivers in general, data from Indiana in-depth and on-site collision investigations indicate the importance of attention and environmental scanning behavior in crash causation (in Dewar, 1991). The actions/causes shown, in order of prevalence, were: 1) improper lookout; 2) excessive speed; 3) inattention; 4) improper evasive action; 5) internal distraction; 6) improper driving technique; 7) inadequately defensive driving technique; 8) false assumption; 9) improper maneuver; and 10) overcompensation. While there is a considerable amount of inference involved in these categories, they have supported the importance of attention and visual skills, which Dewar characterizes as "looking in the right place at the right time."

Rothe (1986) summarized young driver faults causing crashes from a review of literature as follows: 1) failure to keep in proper lane, running off road; 2) failure to yield right of way; 3) speeding; 4) driving on wrong side of the road; 5) failure to obey traffic signs; 6) reckless driving; 7) inattentiveness; 8) overtaking; 9) being fatigued; and 10) poor equipment. In a longitudinal study in California, Harrington (1972) had looked at changes over the first four years of driving. Among other findings were that right-of-way violations were more common in females' records, and were especially prevalent in their fatal crashes, warranting an increase in emphasis. Key changes over time were that single-vehicle crashes declined, and the proportion of crashes where the young driver was cited as committing a violation went down. Evans (1987) showed that single-vehicle crashes were much more prevalent among male drivers than females and drastically higher among young males.

Based on violation and collision data, McKnight and Resnick (in Young, 1993 DOT Workshop) summarized frequent youth violations as: speeding, sign non-observance, equipment defects, turning unlawfully, passing unsafely, right of way violations, major infractions, and alcohol. However, based on observation they concluded, "Of several hazardous driving practices thought to be engaged in by young drivers, the authors believe that only speeding can be said to occur more often among youthful than among experienced drivers" (p.c-3). Acceptance of shorter gaps when turning was also reported, although they could not relate this to crashes. They point out that young males' higher incidence of rear end collisions could result either from their shorter headway choice or higher speed.

Trankle *et al.* (1990) reviewed predominantly European research and concluded that young drivers are overrepresented in only a few types of crashes: speed-related, loss of control, and nighttime crashes. Inappropriate speed in curves and cutting curves were frequent factors.

Differences Between Novice and Experienced Drivers

Waller (1983) suggested that driver education should only address those skills that can be shown to differentiate between novice drivers and experienced drivers with good records. This was again identified as a research need in the 1991 Traffic Injury Research Foundation/Insurance Bureau of Canada Symposium *New to the Road* (TIRF, 1991). A major review of differences in skills and motivations between experienced and novice drivers is currently in preparation in Canada.

Risk Perception

Research evidence addressing the factors accounting for young drivers' excess collision risk was also reviewed in a detailed study by Jonah (1986). He pointed out the inconsistent findings among studies of young drivers' overall perception of their own risk of crashing, compared to older drivers. It was clear that they perceived specific actions, such as speeding, tailgating, or driving impaired, as less risky than did older drivers, and that they rated traffic offenses as less serious. He contrasts these with Finn and Bragg's (1986) finding that young drivers rate potential pedestrian conflicts and driving on snow-covered roads as more hazardous, and outlined other research that showed young drivers were more likely to rate fixed roadway objects as hazards and less likely to rate moving objects as hazards than older drivers. Since Jonah reports earlier Canadian data that shows young drivers are more likely than older drivers to strike fixed objects, perhaps there is some basis for their concern with them.

Jonah (1986) also highlighted research that showed drivers under 25 were slower to recognize potential hazards and that less experienced drivers were less good at identifying distant potential hazards than more experienced drivers, while they were equal with respect to nearby ones. Discussing Mourant and Rockwell's (1972) evidence that novice drivers' eye movements show fixations closer to the car, Jonah suggests it means that they are so preoccupied with lane tracking that they lack the spare mental capacity to search ahead for potential hazards. Mourant and Donohue (1977) investigated mirror scanning through eye movement recording and found that novices and even young drivers with considerable experience looked at their side mirrors less, and novices were more likely to make direct looks instead of using the mirrors. The authors recommended finding ways to train for better mirror use.

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Brown and Groeger (1988) suggested that the critical need for driver training is to find ways to improve novice drivers' perception of hazards and of their own ability to cope with them. They reviewed earlier work that showed poor hazard perception in inexperienced drivers, including work by Brown that showed young drivers to be relatively worse at estimating distant hazards than near ones, compared to experienced drivers. They also cited work that suggests training in self-perception of ability to handle hazards can be helpful, as was found by Schuster (1978). Schuster provided student drivers with feedback about their performance on a collision-avoidance knowledge test. Increasing levels of feedback were assessed based on the hypothesis that students would be affected by the amount of feedback given them about how experienced drivers reacted safely in potential crash situations. Collision rates were expected to be negatively associated with level of training and feedback. The maximum training condition consisted of receiving feedback from taking two alternative forms of the test. Collision reduction in the first year for the group that received the most training and feedback was a substantial 75%, which was statistically significant even with the small numbers involved (total n=192).

Jonah highlights Matthews and Moran's (1986) suggestion that young drivers tend to overestimate the risk of low- and medium-risk situations and to underestimate risk in high-risk situations. He suggests, "The weight of empirical evidence tends to support the view that young drivers may take risks more often because they are less likely to recognize risky situations when they develop. The evidence seems to be more supportive of this view when the driving situation is specific (*e.g.*, impaired driving, tailgating)" (p.265). This raises the difficult question of why young drivers engage in riskier practices, whether it is caused by failure to perceive risky situations and potential hazards or by greater acceptance of risk.

Risk tolerance, risk perception, and skill are seen as the most critical factors for young drivers' crashes by Trankle *et al.* (1990), with risk perception seen as most important. In their research, young males rated slides of driving scenes involving dark, hills, and rural environments as being less risky than did older drivers. Young female drivers rated curves as more hazardous. Young males rated high speeds as less hazardous than did young females. The authors concluded that the underrated situations "provide few explicit danger signals" (p.123). This is consistent with other findings that young drivers have a reduced ability to extract the full richness of available information from the environment. We could speculate that this relative inability to extract information from the environment, along with a high need for stimulation, could, in part, account for young drivers' tendency to drive faster than more experienced drivers. This would open the possibility of a skill improvement – better detection of potential hazards – leading to a change in one of the motivational bases of speed choice. Slow or inaccurate hazard detection and choice of high travelling speeds are a particularly risky mix.

> ***…young drivers may take risks more often because they are less likely to recognize risky situations when they develop.***

Does Everybody Know Why Speed Kills?
It is not clear that the effects of higher driving speeds have been fully studied or thought out, and it may be that novice drivers have an imperfect grasp of why, and how drastically, speed affects their risks. As novices gain some confidence in basic vehicle handling, they can drive well over the average speed of traffic (which they can observe is often well over the posted limit) for quite some time without any apparent problem. They may even be reinforced in this behavior by thinking that it is their skill or luck that lets them do what they have been told is so dangerous with such apparent ease and impunity. This is one of many areas where we need to establish beliefs, motives, and habits that are counter to the apparent reality and natural reinforcers in the novice driver's world. These are tall orders for DE, requiring strong and clear understanding of the psychology, physics, and road engineering implications of different speed choices and "speeding." The physics of speed and stopping distances and impact severity are reasonably well spelled out in modern texts, although the necessary distinctions among different levels of excess speed seem neglected.

It may well be that the main effect of "expected" speeding (that is the common 10-20% over the posted limit) is to raise the average severity of crashes and the number of severe casualties, rather than producing more crashes overall (*e.g.*, Streff and Schultz, 1990). Because of the physics of impact, the extra speed aggravates the effect of crashes that happen for other reasons. The added risks of speed violation are fairly substantial over the whole population, but may appear modest to the individual. The choice to avoid speeding probably has to be made on the basis of social responsibility rather than perceived individual risk reduction. This risk of speeding is quite different from that produced by "unexpected," very high speeds (say 50-

100% above posted levels). At extreme levels the speed itself may be the primary cause of the crash, either through exceeding the envelope of control available in the roadway geometry or through violating another road user's expectations.

Certainly speed is a key to novice drivers' errors. Indeed, few of the potential hazards that befall novice drivers on the road would become actual hazards if the driver were far enough away from them or going slowly enough. The psychology and engineering aspects of speed seem less than clearly understood and communicated in educational programs. This seems particularly true in crucial matters of expectancy, especially that of other road users, whose expectations the novice may unwittingly violate. The effects of distance, and therefore indirectly of speed, on perception of closing distance may also be important, given the novice's high incidence of rear end collisions and run-off-the-road crashes in curves.

Risk Acceptance

Jonah provides a good summary of research on the positive and negative value (or "utility") of risk for young drivers. He summarizes suggested positive utilities such as: outlet for stress, impressing others, increasing stimulation or arousal, taking control and acting independently, opposing adult authority, frustration, fear of failure at school, and peer acceptance. He lists "disutilities" of risk as: death or injury, injury to others, property damage and higher insurance premiums, loss of driving license, fines, and parental censure. He also points out the lack of empirical evidence regarding the relative importance of these motivational factors in the young driver's risk equation.

A highly suggestive finding of reviewed earlier research is the relationship between measures of sensation-seeking and higher driving speeds. Clement and Jonah (1984) found a significant relationship between sensation seeking and driving speed on the highway. Ultimately Jonah seems to opt for higher risk acceptance, or even risk seeking, as the explanation for young drivers' risky driving, outlining Jessor's earlier work on "psychosocial proneness to problem behavior" (see also Jessor, 1987). Naatanen and Summala (1975) and Summala (1987) referred to "extra motives" of young drivers, that is extra to the "'official' goal of the transportation system, *i.e.*, safe transport" (Summala, 1987, p.84). These include: competition; tension reduction; showing off; sensation seeking; deliberate risk taking; and social norms or models from advertising, rally drivers, peers, and other drivers on the roads. Based on Finnish data, Summala suggests it takes about 50,000 kilometers (30,000 miles) of driving "before a young driver has satisfied his strongest extra motives and learnt to use the car rationally – or as rationally as the older driver" (p.87). Basch *et al.* (1987) studied young drivers' expressed attitudes, concluding, "Although as adults we may view risky driving behavior by young drivers as irrational, the results of this study produce convincing evidence that risky driving behavior can, for young people, provide valuable social rewards" (p.109).

In a clear statement of young drivers' motivational risk factors, Jonah summarized his review findings as follows:

> *Although driving exposure and experience do account for some of the variance in accident risk, the weight of the evidence also implicates driver risk taking as a major factor underlying the higher accident risk among youth. Young drivers drive faster and closer to the vehicle in front of them, they accept narrower gaps and are more likely to run yellow lights...risk has greater utility among youth primarily in the expression of emotions like aggression, the seeking of peer approval, the facilitation of feelings of power and the enhancement of self-esteem. Moreover, there is some evidence that youth tend to underestimate the disutility of risk (e.g., being killed or injured in an accident). This might be a function of young people's perception of themselves as being invincible. Death is a very remote event for most young people (p.268).*

These conclusions underline the importance of individual motivation and social responsibility for young drivers' safety on the roads. Certainly, their tendency to choose to operate in risky ways makes their motivation the most critical concern. Nevertheless, skill deficiencies and inadvertent errors may have a more important role for novice drivers, at least very early in their careers, than for experienced drivers. Quadrel *et al.* (1993) studied feelings of invulnerability and found adolescents to be no different from adults, who also see themselves as facing less risk than others. As well, Wilde (1994b) has recently pointed out that driving may not be a fully self-paced task for drivers whose skills are very low. These drivers are not able to fully adjust their manner of driving to their skill level, because they operate as a small minority among the majority of experienced, more highly skilled drivers. The inexperienced drivers are perhaps pressured, or at least induced, to drive as fast and at the same short headways as other drivers whose skills warrant them. If this hypothesis is correct, it reinforces the need for rapidly increasing new drivers' hazard recognition and related skills, and for diagnostic feedback for self-awareness of skill and risk.

Elander *et al.* (1993) reviewed behavioral correlates of differences in crash risk. They concluded that both skill (what the driver can do) and driving style (in effect, what the driver chooses to do) are critical. In skills, they found perceptual ability (ability to perceive targets in complex environments and switch attention, and the speed of detecting hazards) as most important. Regarding driving style they wrote, "...the key style factors relate to driving faster and willful commission of driving violations." They also suggested linking diagnosis of basic perceptual/cognitive abilities to training, so that drivers could better understand their own limitations and compensate for them. A diagnostic self-awareness component may be considered important for DE curricula in the future as they become more precisely targeted to individual needs. A number of researchers have shown that measures of attention predict crash records (*e.g.*, Arthur, *et al.*, 1994).

Differences in young drivers' risky decisions were studied by observation in an intersection situation by Konecni *et al.* (1976). They found that young males travelled much faster on a major arterial road and that they were more likely to run yellow and red lights. However, they were also seen to slow down more often before running the yellow, making it even more likely that they would be caught by the red. Their longer decision time in deciding whether to stop was attributed to their higher speeds and therefore greater distance from the intersection during the critical decision period. Their inexperience may also make it harder for them to respond as quickly in this complex situation, because they do not have the judgment or decision rules as well-established as more experienced drivers. Wasielewski (1984) also observed substantially higher driving speeds for young drivers. Evans and Wasielewski (1983) found young drivers to choose shorter following distances on the freeway, and that the drivers choosing short headways had worse driving records. Summala (1987) concluded from review of earlier research that young drivers' short headways were a product of choice rather than not knowing the proper decision rule or how to apply it.

...young drivers' short headways were a product of choice rather than not knowing the proper decision rule or knowing how to apply it.

Flowing from his *Risk Homeostasis Theory* (RHT), Wilde (1993) suggested that DE should concentrate on two objectives: 1) improving collision-risk estimation skills; and 2) reducing young drivers' willingness to take risks while driving. Wilde (1994a) has pointed out that young drivers have, except for a few more years of life, less to lose from risky driving, having fewer responsibilities to others, fewer accomplishments, etc., than older drivers. They also have more to gain from risky driving behavior, in terms of peer approval, expression of independence, feedback on task mastery, and actual learning of maneuvering skills under pressure (*e.g.*, Jessor, 1987).

Wilde sees risk acceptance decisions as being based on the individual's choice of balance between the costs and benefits of choosing either a safer or less safe option. He refers to the preferred balance as the individual's "target level of risk." Relating risk acceptance to education, Wilde (1994b) offeres the following definitions: "By education we mean the effort to enlighten, to civilize, and thus to impart more mature views, beliefs, and values, while training refers here to the instilling of the practical perceptual, decisional, and motor skills. The notion that people could be educated to lower their acceptance of accident risk is not incompatible at all with the postulates of RHT." The figure below illustrates a simplified decision matrix as implied by Wilde's model, showing examples of some of the benefits and costs that the novice driver must consider.

Lessons From Training of Advanced Skills

Lonero *et al.* (1995) reviewed evaluations of advanced driver training programs, (*e.g.*, McKnight *et al.*, 1982; Lund and Williams, 1985; Whitworth, 1983). Advanced training, of both the defensive driving and collision avoidance types, holds out attractive possibilities for skill improvement, at least in certain segments of the driving population. However, it is reasonably clear that practical safety benefits will only occur if these programs are coordinated with motivational influences. Otherwise, there is a clear danger that "...increased skills raise the level of aspiration in driving (higher speed, more frequent overtaking, smaller margins of safety, etc.)" (Naatanen and Summala, 1974, p. 243).

Anecdotal evidence suggests that exposure to a brief Canadian collision avoidance training program (Labatts Road Scholarship) can affect expressed attitudes regarding driving risk, at least immediately after the training session (G. Magwood, personal communication). Perhaps these brief courses are too short to produce subjectively perceived skill improvement, whether or not they increase actual emergency vehicle-handling skills. Such training could have beneficial motivational effects – if by showing young drivers their vehicle-handling limits it reduced their overconfidence in their abilities. A driving range or simulator component specifically addressed to this issue could be considered for inclusion in a new curriculum. It would presumably be best sequenced in the later stages of a graduated system, where it could meet developing overconfidence head on.

The evaluations of these more specialized driver training programs suggest the counterintuitive conclusion that, all other things being equal, raising levels of driving skill does not reduce crashes. In some cases car handling training is actually associated with a higher crash risk (*e.g.* Glad, 1988; Jones, 1993; OECD, 1994; Siegrist and Ramseier, 1992).

Figure 1-1 - Benefits and Costs of Cautious and Risky Behaviours

	BENEFITS	COSTS
CAUTIOUS BEHAVIOR	Avoiding damage & injury Feedback & rewards Satisfaction of "doing right" Fuel & wear savings	More time, effort, attention Less exciting, boring "Wimpy" image, peer problems Less practice near the "edge"
RISKY BEHAVIOR	Less time, effort, & attention Sensation seeking "Macho" image, peer approval Practice near the "edge"	Possible damage & injury Possible Punishments Loss of feedback, rewards Fuel, wear & tear costs

…the belief of being more skilled than fellow drivers increases confidence in one's abilities more than it increases actual abilities.

Jones's (1993) findings were particularly interesting, in that the affected drivers showed (marginally significant) worse records overall, but better in the slippery conditions to which the training had been addressed. Glad (1989) found a negative safety effect of a mandatory second-phase slippery-road training session only in males, with no effect in females. Williams and O'Neill (1974) found much earlier that licensed amateur race drivers, as a group, had rather poor on-road driving records, despite their presumably superior car-handling skills. These findings of a negative effect of improved car handling skills is consistent with a number of other European studies reviewed in the OECD report on behavioral adaptation (OECD, 1990). The OECD committee stated,

> *This apparent contradiction could be explained as follows: the belief of being more skilled than fellow drivers increases confidence in one's abilities more than it increases actual abilities. A high confidence in one's abilities could lead to an aggressive style of driving that could lead to more critical situations. If the driver's increased skill is not in proportion to the increased number of critical situations, then there will be more accidents (p.79).*

Focusing Driver Training and Education on the Most Critical Objectives

It is clear that young drivers' collision risk is the result of a complex set of individual and social factors, operating primarily through their cognitive abilities and motivations. To make a major impact on their safety performance we must influence the most critical aspects of both what they can do and what they choose to do on the roads. The most critical skills are those that determine their appreciation of risk and their ability to acquire and process information from the environment. Perhaps even more critical, however, than these perceptual/cognitive skills are the motivational factors that energize behavior and direct what drivers choose to do with their skills.

A recent road safety report by the Organization for Economic Cooperation and Development pointed out a definitional problem with drivers' motivations. The report suggests:

> *The term 'attitude' is often applied casually for all internal psychological processes that contribute to road user behavior. It seems necessary to warn against such an expansive use of the attitude concept, as it may cause a tendency to overlook the many different functions of and backgrounds for road user behaviour and consequently lead to inefficient countermeasures ... one will often find that attempts to modify attitudes may better be replaced by pure behavioural strategies...(OECD, 1994 p.77);*

and

> *Another problematic element is the apparent large discrepancy that can exist between attitudes, intentions, and actual behavior. Many drivers appear to have "good" attitudes (and driving skills) yet still drive in a dangerous way because they fail to recognise the problems associated with their own behaviour (OECD, 1994 p.37).*

While many past road safety efforts have attempted to "change attitudes," few have succeeded in changing behavior. Past failures are likely due, at least in part, to the fuzzy nature of the driver attitude concept. To better focus DE on novice drivers' motivations, the challenge will be to develop a more refined model of the factors that "drive" driver behavior. These are divided into two basic categories, or "educable qualities." First is individual *motivation*, which includes all the individualistic drives and needs, including self control, risk tolerance, emotions, incentives, disincentives, and stimulus seeking. Second is social *responsibility*, which includes a wide range of culturally-determined needs, including "active caring" (Geller, 1991), leadership, conscientious self-monitoring, and environmental protection. As with the other targeted qualities of the driver, these motivational qualities are broken down into more specific topics and performance objectives in Section 3.

Focusing Driver Training and Education on the Most Effective Methods

Ivan Brown concluded an address on driver training as follows:

> *The gist of my message is that we do not yet know how to train safe driving behaviour that will persist through the early years of traffic experience. This is because driving is a self-paced task, in which drivers meet personal criteria of safety by attempting to match perceived hazards in traffic to their perceived abilities to cope with those hazards. Training needs to focus explicitly on the balance between these two components of subjective safety...rather than simply teaching "ideal" driver behaviour (1989, p.16).*

Many improvements in technology and understanding have taken place in the last two decades. Participational and interactive program structures for education are widely seen as desirable and are now much more feasible (*e.g.*, Geller, 1990). The particular needs of target learners, both as members of groups and as individuals, can be addressed by adaptive instructional technology. Computer-based instruction and part-task simulation have reached a point where we are now ready to make use of their largely untapped potential for influencing safer behavior (*e.g.*, Gopher, 1992). More individualized and self-paced instruction, with active involvement of parental and peer influences, are seen as crucial. The background for suggested directions in instructional methods and media are discussed in Section 4.

Much of the knowledge content, values understanding, motivational issues, and social responsibility issues in DE are also relevant to other areas of life and other educational fields. Linking and integration with other educational subjects, which can provide benefits in both directions, is discussed in Section 5.

Linking Driver Education With Other Behavioral Influences

Longer-term improvement of collision rates is a major challenge, probably requiring an **influence program** stronger than even an advanced driver education curriculum. To improve collision rates per driver enough to offset increased licensing rates for trained teenagers adds to the challenge. It is possible that no practically implementable education or training package alone will be able to do this. A broader program, including motivational, social, family, and community influences is probably required.

A comprehensive planning approach is needed if one wishes to implement an effective, multi-faceted behavior-change program. Changing organizational behavior becomes as much of an issue as individual change. The most comprehensive health promotion model is ***PRECEDE/PROCEED*** by Green and Kreuter (1991). This model addresses the planning and evaluation needs in health promotion and health education, but it can provide some guidance for safety programming as well. The model outlines a series of phases in the planning, implementation and evaluation of programs: 1) social diagnosis; 2) epidemiological diagnosis; 3) behavioral and environmental diagnosis; 4) educational and organizational diagnosis; 5) administrative and policy diagnosis; 6) implementation; 7) process evaluation; 8) impact evaluation; and 9) outcome evaluation. The framework takes into account the multiple factors that shape health and assists with the identification of a specific subset of these factors as targets for intervention. This model was adapted by Lonero *et al.* (1995) for more specific application to the planning and management of comprehensive road safety programs, primarily for states, provinces, and their constituent communities.

While various types of support from the national, state, and provincial levels are crucial, the key to real progress is likely the development of more effective influence programs at the community level. To achieve measurable and lasting safety improvement in the performance of novice drivers, it is likely necessary that driver education, the family, the community, and licensing and other regulation become more closely aligned and "synergistic" in their influences. Linking driver education into a broader program of driver influence is discussed further in Sections 6 and 7.

SECTION 1 SUMMARY

- Novice drivers are greatly overrepresented in crashes.
- The purpose of this project is to initiate program development to "reinvent" a more intensive and comprehensive form of driver education.
- Driver education has declined just as the driver/vehicle/roadway system is becoming "technologized" and harder to understand.
- Reaction to the SPC/DeKalb experiment knocked the wind out of DE, even though DE showed some positive effects.
- People learn to drive whether we educate them or not, but they may learn more slowly without DE.
- Drivers learn both desirable and undesirable behaviors mostly through experience.
- Novice drivers are less able to control attention, scan the environment effectively, detect potential hazards early, and make tough decisions quickly.
- Novice drivers perceive less risk in specific violations and high-risk situations but more risk in lower-risk situations.
- Novice drivers more often choose to drive too fast and too close to others, accept small gaps in traffic, have unrealistic confidence in their own abilities, and leave inadequate safety margins.
- Training needs to be more sharply focused on perceptual and cognitive skills.
- Education needs to better involve novice drivers' individual motivations and social responsibility.
- DE is given a tougher mission than other forms of education and should therefore become a leader in participational education in the classroom and self-paced, automated training in the lab.
- Effective reduction of novice drivers' crashes will likely require linking DE more closely with parental and community influences, licensing, and other behavioral influences such as incentives and disincentives.

2. CURRICULUM OUTLINE STRATEGY

The purpose of the study leading to this report was to identify and outline a new direction for driver education, which will better accomplish its general missions and meet its goals in supporting the needs of its various stakeholders. Since some of the values that DE is supposed to further are fundamentally contradictory, it will never be able to perfectly satisfy all of them, and success will always be a question of balance. This paper is intended to outline a strategy that will help DE shift its balance toward a greater safety impact.

2.1 DRIVER EDUCATION'S MISSIONS

DE seems to be assigned a broad and somewhat inconsistent set of missions in North American society.

Mission 1 – Support safety outcomes

Driver education should make a measurable contribution to a net reduction in the collision losses associated with the mobility of its graduates, compared to informal means of instruction.

Mission 2 – Support the mobility of new drivers

Driver education facilitates the independent mobility of its graduates. It helps them develop the competence and confidence needed to become drivers and to inspire sufficient confidence in responsible adults and authorities to permit them to enter the driving population.

Mission 3 – Support broader educational outcomes and societal values

Driver education exploits and supports broader educational resources in health and safety, literacy, numeracy, social and environmental understanding, and practical knowledge in other subject areas. DE is expected to produce a net improvement in its graduates' use of fuel and other resources, such as vehicle components. It should support more effective consumer behavior and resistance to irrational commercial pressures, and it should foster improved commitment to community responsibility and leadership in its graduates. DE is also a commercial service industry, as well as a user of public resources, and it must provide a return on investment and effort.

2.2 STAKEHOLDER NEEDS

Driver education has a broad range of stakeholders, with varying needs and interests (See Chart 1). DE's retail customers include aspiring novice drivers and, in most cases, their parents/guardians. Adult novices are a minority, but they may have special needs, especially in a new program that is more sharply focused on the motivational and responsibility issues in young novices, and which includes a stronger parental role. Students, regardless of age, are primarily focused on driving mobility and its benefits, with safety and other values quite secondary. Parents/guardians also have a major stake in their youngsters' independent mobility, but can be expected to place more emphasis on safety and other values, particularly economic ones. Parental supervision of initial driving practice and of solo driving later takes on greater importance, particularly as the process of learning to drive is extended under graduated licensing systems.

DE curricula and supporting materials are developed, produced, and distributed by government agencies, private motorist and safety organizations, and private publishers. They must operate within economic limits, satisfy their diverse constituents, members, stockholders, and other publics, and deliver instructional products that meet the needs of their customers, primarily school authorities in private and public high schools and managers of commercial driver training schools.

DE is delivered by a diverse industry consisting of school authorities, commercial operators, and various combinations of the two. They must be able to deliver an educational outcome that satisfies their customers and other publics, within economic and other organizational constraints, such as the limited

Driver education is delivered by a diverse industry consisting of school authorities, commercial operators, and various combinations of the two.

availability of highly trained teaching staff, the withdrawal of government funding, and enrollment decreases.

Standards and guidelines, as well as financial support for driver education, have been traditionally provided by various levels of government in different North American jurisdictions, and they perhaps can be seen to represent the general public's interests. States and provinces are most prominent in this role, but a renewed U.S. national role is a possibility in the future. States and provinces set licensing standards and need to coordinate DE with testing and other licensing provisions, such as graduated or provisional licenses.

Discussions with state education and school board/district officials with responsibility for DE and with researchers identified common needs and themes, including:

Process – How DE Is Delivered

- Program revisions including tiered or phased program modules; increased and extended time for supervised in-car instruction; performance-based curriculum; risk management skills; decisionmaking skills; visual training; night-time driving
- Involvement of parents/guardians; collaboration between parents and instructors
- Multidisciplinary approach
- Multi-media, computer-based methods, simulation, self-demonstration, gaming approaches
- Improved materials including AV, CD-ROM, interactive PC-based software
- Review of messages contained in materials to ensure consistency and appropriateness
- Affordable cost to delivery agencies and customers

Outcomes – What DE is to Achieve

- Linkage with graduated licensing systems
- Dependence of standards on the integrity of instructors
- Assessment review; the investigation of innovative approaches, such as self-assessment
- Accountability of delivery systems
- Quality control; improved monitoring of delivery agents
- Recognition of peer influences
- Linkages with national and state educational goals
- Identification of rewards; positive approaches

Barriers to Change

- Need for licensing improvements
- Need for consensus among DE educators on process and outcome priorities
- Funding decreases/withdrawal
- Conflicting delivery systems; different regulatory requirements
- Complex and diverse regulatory requirements across states

Incentives to Ease Restructuring

- Improved teacher training
- Opportunities for regular retraining of teachers
- Identification of alternative delivery systems such as teacher mentors, facility sharing, and computer-based, country-wide university instruction

Additional Resources

- Improved and accessible teacher training, MA degree
- Availability and mandating of teacher reeducation; integrated learning, problem solving, consensus building

- Funding relief at the state and federal levels, including directing monies into development activities
- Linkages with community resources and programs
- Parental supervision of new drivers

Integration and Extension of Education Curricula

- Implementation possible in language arts, social studies, health/well-being, physical education, science, and law
- Re-introduction of traffic safety education for primary grades where it has been dropped
- Use of successful integration models, e.g., alcohol and drug abuse education for K–12
- Curricula that are non-obtrusive and easily implementable
- Need for programs for Grades 6-8, in preparation for DE
- Linkages between appropriate levels of DE concepts and traffic safety education programs

External Influences

- Trend towards site-based management in the education system, leading to decentralized decisionmaking and increased parental involvement in many aspects of education

CHART 1

STAKEHOLDER ANALYSIS SUMMARY

REGULATORS	**PROCESS NEEDS**	**OUTCOME NEEDS**
GOV'T AGENCIES • NHTSA • STATES • PROVINCES ASSOCIATIONS • AAMVA • CCMTA • ADTSEA • RSEA	Tiered or phased program Performance-based curriculum Involvement of parents/ guardians Multidisciplinary approach Multi-media, computer-based methods Improved materials Affordable to delivery agencies and customers	Reasonable take-up by delivery jurisdictions Linkage with Graduated Licensing Assessment review Accountability of delivery systems Quality control Recognition of peer influences Linkages with national and state educational goals Identification of rewards
DEVELOPERS/ DISTRIBUTERS • AAA/CAA • STATES • PROVINCES • PUBLISHERS	Marketable Affordable Materials and media accessible	Safety effective Happy customers Political acceptability Mandatory training
OTHER BUSINESS • INSURANCE • AUTOMOTIVE	More drivers/driving Risk rating	Loss reduction
DELIVERY/ RETAILERS • SCHOOL BOARDS • COMMERCIAL SCHOOLS	Affordable Materials and media accessible User friendly Funded	Loss reduction Satisfied students/parents Adequate enrolment
CONSUMERS • STUDENTS • PARENTS • OTHER DRIVERS • COMMUNITIES	Affordable User friendly Accessible	Collision/conviction free driving New drivers who are responsible, cautious and considerate

- Linkages with community programs and resources that support effective driver education
- Identification of role models in the community, such as peer models, youth group leaders, and other opinion leaders
- Use of DE to promote other educational goals; for example, as an incentive to stay in school (*e.g.*, must be a sophomore before DE is available) or linkage to truancy (*e.g.*, license suspension if attendance is low)
- Experiential learning in the community; e.g., assignments to study road safety issues such as a dangerous intersection or relevant council meeting discussion

Insurers have a major interest in novice drivers, as current and future customers and difficult underwriting risks. In some jurisdictions they help to market DE and to enforce standards through premium discounts for graduates of approved DE courses. Premium discounts have traditionally served to encourage DE participation, to provide an attractive marketing tool for parents facing large premium surcharges, and perhaps to help insurers select better risks. Premium discounts are somewhat controversial, in light of failures to demonstrate net safety effects of DE, but they are difficult for individual insurers to drop because of competitive pressures. In British Columbia, which has a single, government-owned auto insurer, the discount has been dropped. Innovative means of providing incentives to DE graduates are being explored by some insurers and are discussed in Section 6.

Various other organizations with road safety mandates take an active, though typically sporadic interest in DE, as advocates, critics, research contributors, or evaluators. There appears to be little focus for or coordination among these potentially powerful resources, although reentry of the NHTSA into the field could help to turn this around. Some U.S. universities serve as academic educators and researchers for DE. The universities can provide interdisciplinary links among safety education, health education, health promotion, and behavioral psychology. There is no comparable resource in Canada.

Chart 1 summarizes the critical needs of key stakeholders. This information reflects the opinions of a small number of contacts in each group and should not be assumed to be entirely representative or complete. However, common themes and concerns have been identified and given consideration during the development of this outline.

STAKEHOLDER ANALYSIS SUMMARY

2.3 UNDERLYING STRATEGIC ASSUMPTIONS

2.3.1 Fundamental concepts

The definition of driver education assumed here is a broad one. It includes: 1) the training of novice drivers in on-road driving skills; 2) the background knowledge and other abilities that support these skills; and 3) the values, motives, and sense of responsibility that determine how they will be used. Indeed one of the key strategies is to further broaden the definition to let it provide direction and leadership to families, communities, and others with potential influence over novice drivers' performance. A working definition of a new DE might be:

An organized set of educational experiences and other influences during the transition from novice to experienced driver, intended to enhance abilities relevant to driving and influence actual performance throughout the driver's career.

It has been suggested that it is time to develop an alternative term to replace "driver education," as that term may be too firmly linked to the current structures. No clearly superior candidate has yet presented itself, however. "Road safety education" is already in use in some jurisdictions, linking DE to earlier forms of road user education. This longitudinal extension of the concept is a worthwhile effort, where K-12 safety education can be supported. It does not, however, fully meet the needs of concurrently influencing the novice driver and countering the negative influences that teach poor habits to the novice driver. A better term would be one that implied activation and coordination of family, community, and regulatory influences along with expanded instruction. Perhaps some term like "driver preparation," "driver apprenticeship," "driver transition," "community driver education," or "driver community development" could serve as a basis for discussion towards a name that better fits an expanded definition.

Basic to any educational or other influence effort are assumptions about what critical deficiencies would exist in the absence of the intervention. We should be clear and as correct as possible about: 1) what is lacking in the behavior of novice drivers that needs to be corrected; 2) what growth in ability and character needs to be encouraged; and 3) what *educable qualities* will support these changes. These assumptions dictate the content, objectives, and methods of instruction that are chosen.

With respect to driver education's mobility mission, these needs have been fairly clear. We assume that:

New drivers need to be taught psychomotor and cognitive skills to handle a vehicle and interact with other road users adequately to pass a licensing test, satisfy the concerns of parents/guardians, and become independently mobile.

DE programs have supported mobility sufficiently well in the past to have been accused of causing earlier licensing and, as a result, inducing excess exposure to risk. However, decline in support for DE and resulting reduced availability appears to produce some reduction in licensing and mobility, even given the typically modest testing standards prevalent in most jurisdictions.

As discussed in the introduction, driver education is nearly unique among educational curricula in its mission of influencing bottom-line outcomes, that is, how safely its graduates actually perform later in the outside world. Even health education initiatives are usually considered successful if they reduce risky behaviors of the target audience, not the actual incidence of disease. Only a few very comprehensive community health promotion programs have been given bottom- line evaluations (Lonero *et al.*, 1995).

With respect to safety, the assumptions underlying some earlier DE curricula and structure have apparently not been altogether correct, as the resulting programs were shown to be ineffective for improving net safety. DE can produce drivers with better skill and knowledge, but they seem to crash at about same rate as drivers with less training and lower abilities. The better trained and more able drivers apparently experience more exposure to risk, because they are licensed earlier and perhaps have more confidence and are given less supervision by their parents. In effect, the better training seems to induce motivational and social forces that balance out the benefits of better skills and knowledge. There may be specific ability improvements that could further improve safety performance, and this should be a priority for DE. However, it is unlikely that skills improvement alone will outweigh the motivational and social forces that raise novice drivers' risk. Nevertheless, it is important to improve the effectiveness of training perceptual and cognitive skills, and especially the efficiency of the training of basic driving skills. It is reasonable to assume that:

Improved training of driving skills is necessary but not sufficient for driver education to better achieve its safety mission.

Drivers have been learning about the roadway system and the social norms surrounding its use, in most cases, for many years before they appear for formal training. Novice drivers also learn a great deal from operating in the system during and after their formal training. As Fuller (1990, 1994) has pointed out, the inappropriate behavior that leads to crashes is learned along with the beneficial learning effects of experience. Fuller suggested that the

Driver education can produce drivers with better skill and knowledge, but they seem to crash at about same rate as drivers with less training and lower abilities

highway system is very forgiving of errors and violations. As a result it "shapes" some highly undesirable aspects of behavior by effectively rewarding it most of the time and only occasionally (but perhaps very severely) punishing it. We know that low-probability punishments, even if severe, generally have little effect on behavior, while frequent small rewards have a very strong effect.

Novice drivers are overrepresented in certain kinds of crashes, such as striking the rear of another vehicle and single-vehicle crashes, with differences between males and females (Trankle, Gelau, and Metker, 1990). However, we are unable to specify with the precision desired by, say, the behavior analyst or industrial psychologist, just what are the most critical errors. We know that some skills differ between novice and experienced drivers, the most critical probably being potential hazard detection, and that novices' appreciation of risks is different from that of mature drivers. Inappropriate speed is a major concern, but we can assume that it only occasionally results in a crash, in combination with other factors. While many drivers exceed the speed limit, young drivers typically choose higher speeds than more experienced drivers. Their excessive speed could result from choice and risk acceptance, or from their inadequate perception of the environment, or both. Clearly both need to be addressed to give us the best chance of achieving DE's safety mission. It should be assumed that:

What drivers can do (their skills and abilities) and what they choose to actually do (based on their individual motivation and social responsibility) are both important to their safety performance – but good motives make up for poor skills better than good skills make up for poor motives.

More recent curriculum development has quite reasonably assumed that there is a need for greater emphasis on risk perception and decisionmaking skills to achieve safer performance. Unfortunately, the safety effects of the existing programs reflecting this assumption are unknown. No recently developed program has been adequately evaluated for ultimate safety impacts. Such evaluation is a monumentally difficult task if conceived as a one-best-shot crucial experiment, as was done in the DeKalb County experiment.

...good motives make up for poor skills better than good skills make up for poor motives.

Evidence suggests that novice drivers, particularly young males, willingly accept more risk, and perhaps even seek it (*e.g.*, Jonah, 1986a, 1986b, 1990; Quadrel, Fischoff, and Davis, 1993). They are apparently also less able than older, more experienced drivers to detect potential hazards at a distance. Since they typically drive faster, they have less time to deal with developing hazards. While weak risk perception and excess risk acceptance may not be totally independent, we are prepared to assume that:

Risk acceptance is not identical with collision acceptance, and continued development of training for risk perception and hazard detection skills will contribute to a well-balanced DE curriculum.

It has also become clear that fundamental issues of motivation, individual autonomy, social adjustment, economic utility, cultural influence, and personal, family, and community values are critical to safety outcomes for novice drivers, as they are for all drivers. Deficits in driving skills and underlying abilities can be compensated for, within broad limits, to increase safety, and superior levels of skill can be compensated by motivation to decrease safety. These findings lead to the assumption that:

Individual motivation and social responsibility, and the broad range of personal and community factors that influence them, should be the highest priorities if DE is to achieve its safety mission.

As discussed in Section 1, the traditional concept of drivers' attitude is inadequate as a motivational target. Verbal expressions of attitudes are relatively easy to change, but such changes rarely lead to behavior change. For instance, many still-sedentary people now express very positive attitudes toward exercise and fitness. Attitude measures, however, such as that of Malfetti *et al.* (1989), can be useful for diagnostic purposes and as intermediate measures for assessing the effectiveness of influence interventions. While attitude measures may be useful, they should not be confused with the fundamental motives that they are intended to reflect.

Actual behaviors are determined by a wide range of influences, and are therefore hard to change. Indeed it may be more effective to change behavior directly, and let the attitude follow, than to attempt the reverse (OECD, 1994). However, because of some successes and broad cultural shifts with respect to other health-protective behaviors, it is reasonable to assume that:

Critical components of novice drivers' motivation and responsibility are potentially educable qualities in most target individuals, within the context of a sufficiently broad education and influence program.

Novices in any complex skill are more prone to errors, even when they have a high level of motivation for successful performance. There is a great deal of variation within the novice driver group (Rolls and Ingham, 1992). At least some proportion of novice drivers are also known to engage in a broad range of what has been termed "problem behaviors." They increase their risk through willful violations of safe practice. The relative contribution to novice drivers' crash risk, and what portion of the target population engages in problem behavior, are not clear. We believe it is correct to assume that:

The target audience is not uniform in skills, underlying abilities, or motivations, and both inexperience and problem-behavior sources of error must be addressed directly by DE on the basis of individual need.

2.3.2 Environment

Over the last few years, demographic trends and economic recession have likely kept down young driver casualties. Economic recovery and increasing numbers of novice drivers entering the population in the "baby boom echo" before the end of the decade lead to the assumption that:

There will be increased market demand for DE and increased pressure for effective reduction in the losses produced by young, novice drivers' crashes.

Driver education has been asked to do a great deal in a very short time with minimal resources. A more effective DE must be broader in scope. However, it will continue to compete with demands of other educational and health and safety programs, and various jurisdictions will continue to differ substantially in the resources made available to it. In the U.S., renewed Federal interest and standards may partially reverse loss of support seen recently in some states. There appears to be no parallel national development in Canada. We can assume that:

Intensification of the DE experience will have to begin more or less within a scale dictated by current resource limitations. Increases in financial support and any expansion in the scale of instructional time or other resources for DE will, at best, only occur incrementally and will depend on demonstrating improved success in achieving its missions.

The levels of training and professional identification of DE teachers and instructors have been rather limited. This suggests the acceptability of and need for DE curriculum materials requiring little professional input from delivery personnel, and it leads to the assumption that:

To be widely accepted, an effective DE curriculum and its supporting hardware and software should be highly developed and packaged for easy and straightforward delivery, automatically wherever possible.

Instructional methods and technologies and other influence techniques have been evolving rapidly, perhaps more rapidly than knowledge about driving tasks. However, it is assumed that:

A significant portion of DE will, in the short term at least, take place in poorly capitalized, low-tech instructional environments.

Even in low-tech settings, more participative and individualized training is possible, to accommodate differences in learning abilities and styles and to better influence the "hard to reach." Computer-based instructional technologies and the installed base of hardware to operate them may evolve rapidly and add strength to DE, however:

Teachers will continue to play a critical role in driver education. The nature of their role will change as the more routine information-transfer *functions are individualized and automated. The role will become more that of coach and facilitator of peer-driven influence of novice drivers' individual motivation and sense of responsibility, and preparation for this new role will be needed.*

There is no strong basis for belief that even a greatly improved DE program, alone, will produce substantially better safety results. Collateral influences from peers, family, community, insurers, and governments are also likely necessary to ensure behavior change. It is assumed that:

The DE industry, school authorities, insurers, governments, families, and communities care sufficiently about safety outcomes that they can be persuaded to undertake the organizational change and autonomy loss that necessarily attend coordinated effort.

Licensing requirements in a state or province will determine the most appropriate overall shape for the DE curriculum and to some extent details of content. Jurisdictions with graduated licensing systems may permit and encourage two-stage driver education. Despite the likely superiority of two-stage programs and the desirability of more uniform training generally, it is assumed that:

To be applicable across North America, a new curriculum will have to provide modular flexibility to accommodate single and multi-stage programs and continuing variability in content, scope, and scale.

The current state of knowledge about the driving task, crash-producing behaviors, novice drivers' particular risks, and the pedagogy of driver training is too weak to permit the development of a new fixed curriculum with a long life expectancy. Almost no practical behavioral intervention is certain to be effective in every situation, and all should be seen as experiments. We can learn from both failures and successes, if we evaluate and adopt a continuous improvement approach. These considerations lead us to assume that:

An effective new DE curriculum will be explicitly developmental, adaptive, and experimental in nature, to stimulate and incorporate rapid advances in knowledge and technology.

2.4 CURRICULUM DEVELOPMENT GOALS

The procedural goal of new DE curricula should be:

To provide a focus around which a more dynamic, technically advanced, and effective form of DE can begin to develop. The curriculum development process should challenge existing structures, and succeeding generations of new curricula should drive both educational and organizational change.

If this goal can be accomplished, a period of rapid development should make today's DE programs look primitive in five years and be close to unrecognizable in twenty. It is worth giving some thought to different time horizons. It is clear that only limited change can be widely implemented over, say, five years. Many people will have trouble being optimistic about any change over that period. However, it will be equally hard to foresee a DE system comparable to current ones still operating in, say, the year 2020, only 25 years away. Change in that time frame seems inexorable. The current challenge is to set the wheels of change in motion in the most desirable direction now, so that a clear start can be seen in five years and the direction refined and renewed for the more distant future.

A single best-shot approach to curriculum development will not likely be possible, or effective if attempted. An ongoing process of continuous improvement, with rich and frequent feedback on a broad range of intermediate measures and an occasional bottom line evaluation, likely could be successful. It may in fact be more difficult to organize and fund, because of the longer time frame required. A full range of intermediate criteria will need to include reliable and valid measures of psychomotor and cognitive skills, knowledge, motivation, responsibility, and leadership, as well as incorporating indicators of the effectiveness of the delivery process.

DE will at best represent only a fraction of the learning that the novice driver will acquire, even during the students' brief exposure to it. Counselling and coaching during DE and astute supervision of progressive driving experience after licensing are crucial. They are best provided by families, with support from DE and others such as community groups and insurers. An important process goal is:

To ensure that DE is seen as a family and community intervention, both taking advantage of the family's strengths in influencing early driving behavior and helping to build those strengths, and serving as a focus for coordinating community and organizational influences.

To influence on-road behavior in desirable directions, DE will have to produce a profound impact. In order to counterbalance the many forces tending to induce unsafe driving, DE's intermediate outcome goal should be:

To measurably improve the skills, knowledge, motivations, and reasonable confidence of novice drivers, making them both capable of and committed to maintaining adequate safety margins and remaining crash free throughout their driving career.

However, while a renewed and more technically sophisticated form of driver education may be initially more attractive in the market and to governments and insurers, the ultimate criterion of safety effectiveness will likely remain critical to long-term support. The outcome goal of a new DE curriculum should be:

To earn the confidence of governments, communities, and families so that it can serve as an effective focus for coordinated influences to measurably enhance the safe, efficient, and responsible driving performance of DE graduates.

SECTION 2 SUMMARY –

Missions: 1 – Support safety outcomes

2 – Support the mobility of new drivers

3 – Support broader educational and societal values

Stakeholders: young novice drivers and their parents/guardians; adult novices; government transportation, licensing, education, and health agencies; other drivers; private motorist and safety organizations; publishers; authorities in private and public high schools and managers of commercial driver training schools; insurance, automotive, and other industries.

Strategic conclusions/assumptions:

- Perception and decision skills contribute to safety.
- Improved skill is not enough – what drivers can do and what they choose to do may differ.
- Motivation and responsibility influences should have highest priority.
- Individual motivation and social responsibility are educable qualities.
- The target audience is not uniform in skills, underlying abilities, or motivations.
- Market demand and pressure for safety effectiveness will increase.
- New DE will begin in a variety of environments including poorly capitalized, low-tech environments.
- DE hardware and software should be highly developed, packaged, and automated.
- The DE industry, school authorities, insurers, governments, families, and communities care sufficiently about safety outcomes to undertake organizational change and coordinate effort.
- New DE will be modular for multi-stage programs and local variability.
- New DE will be explicitly developmental, adaptive, and experimental.

Summary Goals:

- Lead educational and organizational change
- Become a family and community intervention
- Make novice drivers capable of and committed to remaining crash free
- Focus coordinated influences to enhance safe and responsible driving

3. CURRICULUM OUTLINE STRUCTURE

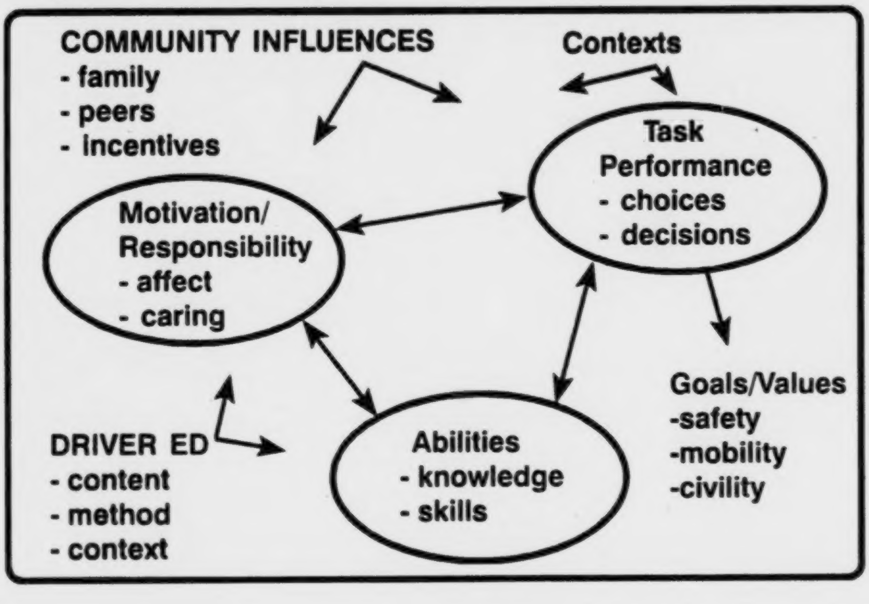
3.1 FRAMEWORK OF EDUCABLE QUALITIES AND OBJECTIVES

A very large number of human, vehicle, and environmental factors help determine how safely a driver performs. A large pool of knowledge, skill, and other qualities could be considered as targets for DE. The content chosen for a DE curriculum must be selected from this pool and structured according to some model of what is most critical for drivers to know and be.

The traditional objectives structure used in scholastic curriculum development is Bloom's taxonomy, which has been in use since the 1950s (Bloom, 1961). Bloom's basic structure of psychomotor, cognitive, and affective objectives was used in part for the OECD's *Guideline for Driver Instruction* (1981), a document whose purpose was similar to that of the present project. The OECD *Guideline* shows the logical problems of Bloom's taxonomy for the driving task. For instance, real-time, on-road cognitive functions, such as attention switching and decision making, are addressed as psychomotor objectives, while the identified cognitive objectives are limited to off-line types of factual knowledge items. It does have the advantage of breaking each of the three basic structures into separate useful and thought-provoking components. Bloom's taxonomy also features motivational, "affective" objectives (Krathwohl, Bloom and Masia, 1964). Human factors models of skilled performance, such as Welford's (1968) time-honored one, typically do not stress motivation, which is critical for safe driver performance. A process based on Bloom's breakdown was used to identify and clarify motivational objectives for inclusion in the objectives structure, supplemented by other models (*e.g.*, Dick & Carey, 1985; Reiser & Gagne, 1983; Robinson, Ross & White, 1985; Gagne, Briggs & Wagner, 1988; Gronlund, 1985; Geller, 1991; Wilde, 1994b).

The driving task is sufficiently different from the subjects of scholastic curriculum development that it seems to require a unique objectives structure. As shown in the figure below, instead of the cognitive, affective, psychomotor division, we are conceptual-

Figure 3-1 Infuencing the Novice Driver


COMMUNITY INFLUENCES
- family
- peers
- incentives
Contexts
Task Performance
- choices
- decisions
Motivation/ Responsibility
- affect
- caring
Goals/Values
-safety
-mobility
-civility
DRIVER ED
- content
- method
- context
Abilities
- knowledge
- skills

izing the field as a triangle with in-car performance at one corner and affective/emotional/social factors at the second corner. At the third are knowledge and skills, including those that may not be used directly in the driving tasks but may influence task performance or influence the affective, motivational processes. These divisions represent: 1) what the driver is capable of doing; 2) what the driver is motivated to try to do; and 3) what the driver actually does.

Linking Goals to Educable Qualities and Performance Objectives

DE's goals can be achieved only by influencing a wide range of *educable qualities* of novice drivers. These qualities include the information processing and vehicle handling skills that they use while driving, as well as the enduring personal traits that they bring into the car with them, such as knowledge, motives, and social influences. Specific performance objectives support efforts to address these qualities.

Many of the performance objectives of different DE curricula have been, and will remain, similar. The requirements for future progress are to refine and strengthen instructional methods and to initiate a shift in emphasis toward:

1. Improving skills in perceiving and evaluating risks; and
2. Enhancing motivation to reduce the level of risk accepted while driving.

The 1981 OECD guidelines had stated,

> *...the essential point and the final goal of any driver instruction is learning how to drive. Accordingly, all activities in a driving school, including the classroom teaching, must serve the development of driving skill (OECD, 1981 p.48).*

The OECD committee did point out that the most critical skills involved information processing (similar to 1 above), rather than vehicle-control skills. They also started to link knowledge, attitude, and motivation, as follows:

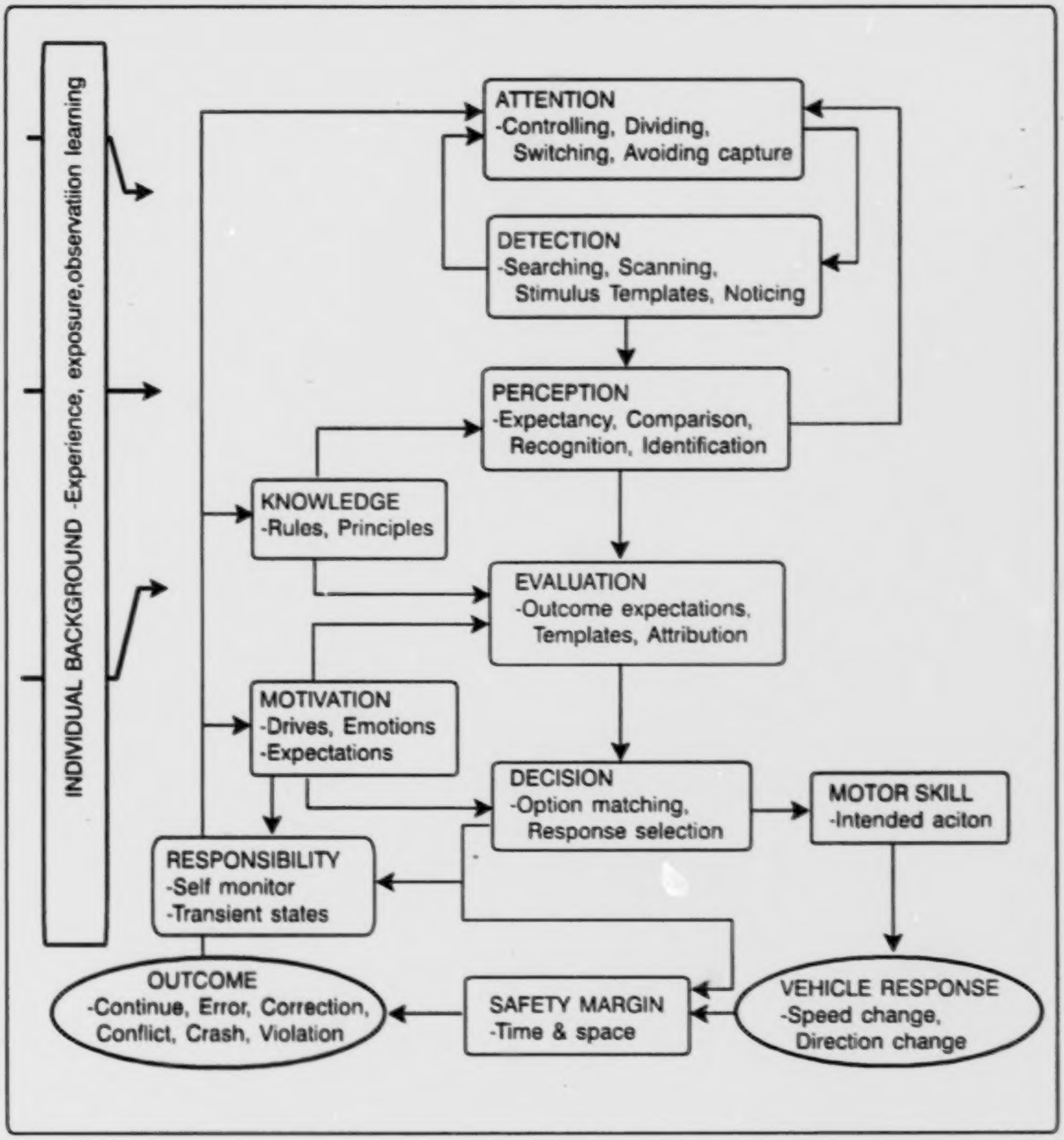
> *In driver instruction as well as in general education there seems to be an implicit hypothesis that knowledge is sufficient to generate attitudes and that these determine behaviour. Empirical data are lacking, and the hypothesis may be questioned because an attitude, in addition to an intellectual component, also contains motivational and emotional components. An alternative and reasonable hypothesis is that systematic training in strenuous traffic situations and in emergencies (for instance braking and steering on skiddy surfaces) may, in addition to improving skill, also have an effect on the driver's apprehension of risks and self-criticism (OECD, 1981 p.11).*

Based on earlier discussions of the effects of high-performance training and attitudes, it is now clear that the existing approach in 1981 and the OECD committee's hopeful new approach to motivational objectives were both wrong. Drivers' motivations are more important, more complicated, and much harder to influence than was appreciated earlier. For DE to achieve motivational objectives requires a much more carefully targeted and comprehensive approach, both to identification of specific objectives and to selection of educational methods.

There are likely as many ways to structure the objectives as there are models of the driver, driving tasks, errors and failures, specific difficulties of novice drivers, and the underlying causal influences for all of the above. Most previous curriculum developments seem to have been based on very simple information-processing models. In contrast, the seminal *Safe Performance Curriculum* (Ray *et al.*, 1980; Stock *et al.*, 1983) was based on an extensive conceptual task analysis (McKnight *et al.*, 1971), with many hundreds of task components

Drivers' motivations are more important, more complicated, and much harder to influence than was appreciated earlier.

Figure 3-2 Qualities Determining Driver Performance


INDIVIDUAL BACKGROUND -Experience, exposure,observatiion learning
ATTENTION
-Controlling, Dividing, Switching, Avoiding capture
DETECTION
-Searching, Scanning, Stimulus Templates, Noticing
PERCEPTION
-Expectancy, Comparison, Recognition, Identification
KNOWLEDGE
-Rules, Principles
EVALUATION
-Outcome expectations, Templates, Attribution
MOTIVATION
-Drives, Emotions
-Expectations
DECISION
-Option matching, Response selection
MOTOR SKILL
-Intended aciton
RESPONSIBILITY
-Self monitor
-Transient states
OUTCOME
-Continue, Error, Correction, Conflict, Crash, Violation
SAFETY MARGIN
-Time & space
VEHICLE RESPONSE
-Speed change, Direction change

identified and rated as to criticality. A number of curricula have been revised and improved incrementally over the years, seemingly with an eclectic theoretical basis, if any.

The mandate of the current project is to step back and take a longer and broader view of DE and its future potential. In light of this mandate it is appropriate to attempt to present a model or structure to stimulate discussion and guide research and curriculum development. We have attempted to move beyond simple models, which appear to exclude too much information that may yield important insights into objectives and methods. The intent is to strike a practical balance, with more detailed analysis than the simple models, but well short of a microscopic task analysis. There are a number of reasons to support this arguably broader-brush approach, not least of which is the hypothesis that a broader influence base needs to be developed or novice driver safety will not be improved, regardless of how thorough the understanding and teaching of specific driving task components. A focus on details of routine psychomotor tasks, for example, would absorb resources better used on objectives more clearly related to safety.

Casting the objectives in a moderately broad scale allows us to keep them closer to proven risk factors than would be possible with more microscopic objectives. This gives us more confidence that achieving the objectives can have some safety impact. For example, a broader performance objective might be smoothness in steering, compared to a narrower objective of knowing the details of how to hold and turn the steering wheel. The broader objective of demonstrating smoothness in steering is more plausibly related to safety than details of holding and turning the wheel. The broader objective involves both visual and motor skills, and it is known that poor visual skills are related to risk and inexperience, and the integration of skills that is reflected in smoothness is related to experience, and therefore perhaps to safety.

The structure for organizing and presenting the performance is ordered for clarity but does not imply teaching sequence or duration, which will be discussed in Sections 4 and 7.

For purposes of organizing objectives we have used the 10 driver qualities shown in the white boxes in the Figure 3-2, *Qualities Determining Driver Performance*, (see page 27). These qualities include the basic traits, states, abilities, and motives used in this simplified driver model. Critical objectives are derived from a model consisting of ten factors, which we have called "educable qualities" of the driver. These ten qualities are not all logically equivalent – most could be considered skills, relating to the on-line, real-time tasks (and errors in them) that lead to crashes. The skill qualities are somewhat more numerous than are usually considered necessary to minimally describe the driver, but our focus necessitates this somewhat finer breakdown. For example, "perception" is often used to group all the driver's information intake activities, but we feel it is important to highlight a number of separate functions and their potential failure and interactions in order to clarify the reasons for certain performance objectives. The topics addressed under each quality are listed in subsection 3.3, and each quality is briefly described in the outline in 3.4, along with key reasons for its priority in the model.

3.2 EDUCABLE QUALITIES AND TOPICS

Under each Educable Quality there are listed a number of Topics relevant to that Quality. In subsection 3.4 below, the Topics are further broken down into Performance Objectives.

1. MOTIVATION

1.1 Risk Tolerance
1.2 Emotion
1.3 Intrinsic Motivators
1.4 Resisting Negative Learning

2. KNOWLEDGE

2.1 Becoming a Driver
2.2 Human Factors in Driving
2.3 Physics of Driving

3. ATTENTION

3.1 Alertness
3.2 Dividing Attention
3.3 Switching Attention

4. DETECTION
- 4.1 Visual Scanning
- 4.2 Detecting Path Deviation

5. PERCEPTION
- 5.1 Seeing With Understanding
- 5.2 Potential Hazard Recognition

6. EVALUATION
- 6.1 Risk Assessment
- 6.2 Other Users' Expectations
- 6.3 Attribution Bias

7. DECISION
- 7.1 Option Matching
- 7.2 Response Selection
- 7.3 Risk Acceptance
- 7.4 Retry/Abort

8. MOTOR SKILL
- 8.1 Acceleration and Speed Control
- 8.2 Controlling Deceleration
- 8.3 Steering
- 8.4 Skill Integration
- 8.5 Error Correction

9. SAFETY MARGIN
- 9.1 Speed Choice
- 9.2 Separation
- 9.3 Early Response
- 9.4 Contexts and Conditions

10. RESPONSIBILITY
- 10.1 Self Monitoring
- 10.2 Internal Conditions
- 10.3 Conflict Avoidance
- 10.4 Seatbelts and Child Seats
- 10.5 Active Caring
- 10.6 Communication
- 10.7 Energy and Environment

3.3 PERFORMANCE OBJECTIVES OUTLINE

The objectives are structured as follows:

0. **Educable Quality** – a desirable skill, trait, or characteristic

0.1 **Topic** – subject areas to be mastered to enhance the desired quality

0.1.1 **Performance Objective** – performance to be achieved by student

In the following outline the performance objectives are listed under each topic, with some rationale and explanation of the specific intention behind the objective. These are intended to clarify what the student is to be and do, and why. How this is to be achieved is left for later discussion. The instructional activities with respect to each of the performance objectives are listed in Appendix I.

1. Motivation

Motivation is defined here as the internal force compelling the individual to seek satisfaction of personal needs. It consists of the appetites, drives, emotions, and utility judgments that energize behavior and direct choices. While motivation comes from within, it may be closely associated with external factors such as individual incentives and disincentives (*e.g.*, Wilde, 1994a) as well as more internal motivators such as personal norms (Parker *et al.*, 1992) or "active caring" (Geller, 1991). The driver model assumed here shows individual motivation as influencing the evaluation of perceived situations and the decisions made with respect to those evaluations – motivation influences what the driver chooses to do, as opposed to what they is able to do.

Topic 1.1 Risk Tolerance

1.1.1 Justify risk aversion with a personal value system

To perform at a suitably low level of risk tolerance, novice drivers should fully value the social and cost consequences to them of having crashes. They should understand available cost information, evaluate benefits/costs of driving risks, and relate them to other types of risks and benefits.

Novices need to become clear on their own values and assess their personal risk preferences. They should be able to identify the relatively low social status and problem behavior typical of high-risk drivers, and they should be committed to low crash risk as an expression of their own self-worth.

1.1.2 Adopt lifetime risk perspective

Each unnecessary risk taken while driving usually adds only a small amount to the driver's overall risk – the roadway system usually "forgives," and therefore reinforces, risky actions. This informal reinforcement of risky actions can lead to the development of risky habits. Novices should recognize that the forgiving system can reward habitual errors. A broad time perspective is needed to be able to calculate and concretely understand the long-term effects of repeated small risks.

To gain a suitable time perspective for their risk calculus, novices need to value future time over present time. This again requires strong positive feelings about their own self-worth, as well as incentives for optimism about the future and an ability to visualize themselves and their situations positively in later life.

Topic 1.2 Emotion

1.2.1 Demonstrate control over emotional reactions to other road users

To learn to gain control over emotional reactions while driving, novices will require both insight and practice. Novices should be able to list emotions and their potential effects on driving decisions, restate the relation between frustration and aggression, and describe other sources of emotional provocation.

Novices should be able to describe strategies for dealing with emotion and to express the value of personal autonomy and control. They should relate emotion in driving to other decision situations, such as games or sports, where "professional" control of emotions is essential for success and is highly valued. They should be able to role-play emotional control under provocation.

Topic 1.3 Intrinsic Motivators

1.3.1 Demonstrate management of personal motivators

Novice drivers must gain insight into and mastery of internal motivation, which can be both positive and negative for safe driving decisions. They should recognize the personal value and satisfaction that can result from growth in their mastery of driving tasks, appreciating the self-esteem growth from self-control/autonomy and the value of lifetime learning.

Novices should recognize their own level of need for stimulation, and be able to discuss the implications of inappropriate stimulus seeking while driving. They should value resisting adverse pressures and plan rewards for managing their own behavior in ways consistent with their values.

1.4 Resisting Negative Learning

1.4.1 Resist negative media and commercial pressures

Resisting adverse commercial pressures and models requires rational consumer skills. Novices need understanding of the economic and other interests of the major stakeholders in highway transportation and how these interests may differ from the long-term interests of the individual driver. They should be able to express realistic skepticism of advertising and entertainment media use of unsafe driving imagery.

1.4.2 Resist negative informal pressures

Novices should understand negative peer influences and the ways the roadway system forgives and reinforces poor driving, such as overdriving headlights at night. Nearly every driver tends to drive too fast at night, choosing speeds that do not permit stopping within the distance that they can see with their headlights. This only rarely leads to a crash, so the behavior is reinforced.

Novices should express confidence in their ability (self-efficacy) to resist cultural pressures inimical to their own interests, such as negative peer influences and poor role models. Again they must value their personal autonomy. To build resistance requires detailed knowledge and practice of specific response skills to resist negative peer influences.

2. Knowledge

The driver's knowledge, like motivation, is a longer term personal characteristic that they brings into the car and that influences driving performance. It consists of a wide range of stored information, including recognition templates, skilled performance routines, rules, and principles. This knowledge store builds up continuously as one receives instruction and experience driving in the system. It influences other driver qualities, as reflected in the model in Figure 3-2.

As Fuller (1992) has pointed out, the knowledge that drivers obtain from experience can be a "two-edged sword": they learn bad habits and risky behaviors at the same time as they become wiser about the operation of the system. As drivers learn the details of how the roadways system works and other road users behave, strong expectations are established, and these expectations can lead to crashes when they are violated. The importance of driver expectancy is recognized in highway design (*e.g.*, Alexander and Lunenfeld, 1986). Wilde (1994b) illustrated the importance of expectancy with the case of a driver who was involved in many collisions (none considered to be her fault) because her extreme caution violated the expectations of other drivers, including a police officer, who then hit her. Including information on the needs and characteristics of other classes of road users, such as pedestrians and cyclists, has been identified as a priority by a recent project of the U.S. National Highway Traffic Safety Administration (NHTSA, 1995 in press).

That novice drivers should know something about the nature of the driving task and about "human performance characteristics" related to it was suggested by the OECD Guidelines (1981). They thought it would be helpful for novices to recognize the complexity of the tasks and their role in the system, in that it could allow them to take a more active role rather than "one-sided rote learning of legislative traffic rules" (OECD, 1981 p.22).

The driver's knowledge influences other components of the driver model, particularly hazard detection and perception and risk evaluation.

Topic 2.1 Becoming a Driver

2.1.1 Recognize how novices differ from experienced drivers

Novice drivers should understand the course of their own learning and that of their peers, as well as the special problems and risks that they face. They should be sensitive to their own progress and apply self-tests to determine proficiency and weaknesses. They should have insight into the impact of an unskilled driver on other highway users.

2.1.2 Describe basic driving tasks

Novices should be able to outline a simplified driver model. They need this in order to understand the diverse tasks involved, the wide variability of drivers' performance, and the importance of impairments.

2.1.3 Internalize reasons for regulation of driving behavior

Driver education students need to have a detailed grasp of the rules of the road, signs, signals, and roadway markings. If these have been learned previously, they should be reviewed for mastery. Students should be able to describe the rationale for regulation of driving behavior on the public roads in general and specific reasons for key regulations, such as those regarding speed, impairment, occupant restraints, and licensing requirements.

Topic 2.2 Human Factors

2.2.1 Recognize range of individual differences/ limitations in drivers

In order to maintain realistic expectations of others, novices should come to understand the wide range of variation in abilities underlying driving performance among individuals. They should be able to restate reasons for variation in perception/reaction times, and to analyze how the highway system accommodates variation in human capacities. They should be able to discuss sources of error in basic driving tasks. They should have expectations that other road users will occasionally behave unpredictably.

2.2.2 Summarize individual needs

Novices need to be able to articulate personal motivations to drive, describe the attitudes of society towards cars and driving, and analyze social roles affected by vehicles. They should be able to describe how motives can change in different situations and over different stages of life.

2.2.3 Appraise consequences of violating other drivers' expectations

Expectancy is a key human factor in highway system operation, and novices are at special risk of violating the reasonable expectancies of others, either through deliberate actions or inadvertently. Novices should be able to analyze road users' expectancies and outline the likely manner and consequences of violating them.

2.2.4 Contrast impaired and unimpaired performance

Impairment is one of the key factors in crashes, and solid, detailed knowledge is important to help novices personalize the potential effects and resist negative pressures, particularly with respect to DWI and fatigue. They should be able to classify sources of impairment, describe the influences of alcohol, fatigue, drugs, and illness, and integrate the effects with their knowledge of driving task requirements. The full range of consequences should be recognized and restated.

2.2.5 Define traffic and highway engineering

Expectancy is a key issue in the human factors of highway operations, and novices should develop realistic expectations about the assistance they will receive from the roadway and should be able to identify potential design/maintenance errors. They should also recognize the reverse, that the system in effect has expectations and assumptions about a wide range of drivers performances, from speed choice to noticing signs, and there are potentially serious consequences to violating system design assumptions. They should be able to restate meaning of design speed, perception-reaction-braking distance, sight lines and distances, and identify key differences and implications for driver performance among highway types.

2.2.6 Recognize needs of cyclists/pedestrians

Novice drivers should be able to analyze traffic interactions from the viewpoint of other classes of road users, recognizing the dynamics of their movements and limitations of visibility and mobility. They should express consideration for more vulnerable road users, and discuss their own previous errors as cyclists and pedestrians.

Topic 2.3 Physics

2.3.1 Assess limitations of car to permit evasive maneuvers

Perception of the realistic risks of driving is reduced somewhat by drivers' feeling of being in control. The actual degree of control varies widely, according to driver ability and to vehicle and environmental conditions. Overestimating available control may be risky, and a realistic understanding of the basics of vehicle dynamics is fundamental to accurate risk perception. Novices should learn the relation of speed to momentum and the envelope of control, and be able to roughly calculate time and distance to stop from different speeds. Knowledge about control at the edges of the envelope may be much different than successful response, and this is one area where a little knowledge may be a dangerous thing. The wide variability of friction conditions and the difficulty in predicting them precisely, even for experts, suggests that this knowledge development should be directed toward motivating novices to maintain a wide safety margin, staying a long way from the edges of the envelope of control.

Novices must fully appreciate the importance of friction and should be able to describe roles of friction in control and define a "friction budget," identifying conditions and reasons for separating steering and braking. Available friction varies drastically with surface conditions, and they should be able to analyze effects of surface differences on friction and locate stopping distances and braking points prior to entering curves under various surface conditions.

The most common skid modes differ between front, rear, and four-wheel drive vehicles. Novices should understand this variation on different surfaces and different vehicles. They should be able to identify characteristics of conventional and antilock brakes.

2.3.2 Describe relation of speed to crash energy

Even relatively minor differences in travelling speeds can have a major effect on crash severity. Novices need to understand the relations between velocity, crash energy, and basic biomechanics. They should have a basic understanding of the human body's injury tolerance and be able to identify injury mechanisms in vehicle occupants and pedestrian/cyclist/ejected victims. The long term impacts of serious, non-fatal injury on quality of life should be fully appreciated.

3. Attention

Attention is meant to include alertness, arousal, and vigilance, essentially "internal" predispositions to respond to the environment. Attention drives the searching, scanning, and noticing that the driver does. It is assumed that attention is both automatic and controllable by deliberate action of the driver, and that the quality of this control can improve through experience. (One might say to oneself while driving up M115 in Michigan, "This is an area of high deer population, so I should pay special attention to movement in the forest edges on either side"). Critical factors in control of attention are dividing it over the many driving tasks and switching the allocation of attention. Attention must be distributed among different spatial areas (*e.g.*, ahead vs. behind) and different categories of objects or information (*e.g.*, objects in the road vs. instruments) (*e.g.*, Allport, 1992). Critical errors can result from failure of any of the attention. Control of attention is related to collision experience (Arthur, 1994), and there is evidence that it is trainable (Gopher, 1992), as well as being improved and eventually automated by experience (*e.g.*, Shiffrin and Schneider, 1977).

It is possible to be "paying attention" and still miss important information in the environment, because of scanning or other detection or perception failures. Our model assumes that attention is necessary, but not sufficient, for the detection of visual targets and other information input.

Topic 3.1 Alertness

3.1.1 Recognize effects of impaired states on alertness

Alertness is fundamental to attention, and novices should understand the range of possible levels of alertness and be able to identify the internal states and external factors that can effect it. They should be able to assess and recognize symptoms of fatigue, preoccupation, and substance effects. They should be able to criticize folk remedies for drivers' alertness problems and identify valid measures for avoiding fatigue effects.

Topic 3.2 Dividing Attention

3.2.1 Self-monitor division of attention over task components

Routine driving requires dividing attention over a number of continuous, simultaneous tasks, such as steering, throttle control, and scanning. The optimal strategy for weighting the ongoing distribution over the separate tasks varies considerably in different conditions. As skill in basic tasks, such as lane tracking, increases, the demand of these tasks for attention declines. The gradual shifting of the distribution of attention is an important part of learning to drive. Novices should be able to perform basic control and guidance tasks while performing other simple secondary tasks.

Topic 3.3 Switching Attention

3.3.1 Model switching rate

The main focus of attention must switch rapidly in routine driving and especially as external situations change. Too much attention to one task or problem (attentional capture) may be as serious a problem as not enough. Novices must learn to switch attention among navigation, guidance, and control tasks as well as monitoring instruments and other ongoing tasks, plus many incidental activities over the full range of driving conditions. Distractors of various types can capture an inappropriate amount of attention, and novices must learn to monitor and deal with distractors. They should be able to list classes of distractors and identify reasons for their varying effects on different people and in different conditions.

It is important to recognize the need for frequent switching and the benefits of an approximately two-second switching rate. Novices should be able to maintain switching, monitor their own performance, and recognize situations that impede proper switching. They should develop strategies for avoiding attention capture or attention "tunnel effects."

4. Detection

Detection includes the driver's searching, scanning, and noticing potential hazards. Errors can occur in which an attentive driver fails to detect, or detects too late, a potential hazard. Even when scanning correctly, it is possible to "look but fail to see," and this is a frequent reported occurrence in crashes. While little is known about why this happens, it is clear that the visual system has distinct limits as to how much information it can take in (*e.g.*, Moray, 1990). At the basic sensory level of the visual system, the eye must fixate on a target to view it clearly. Unfamiliar and unexpected objects are less likely to be detected. It may be that a sort of "pre-recognition" is necessary for an object to be reliably detected, and to the less experienced driver, many more things are less familiar and therefore unexpected.

The model suggests that attention and detection interact, since the drivers mainly detect what they are watching for, either in terms of spatial distribution or category of potential target. What is detected may in turn affect attention, alerting it or altering its distribution in space or over categories of potential targets. The issues of where the filtering processes of attention take place (blocking potential stimuli that are not attended to) are still not resolved in basic research (see *e.g.*, Allport, 1992). While not wishing to try to resolve those issues here, we could theorize that somewhere in this area is the source of drivers' "looked but didn't see" errors. It could also mediate novice drivers' slow reaction to potential hazards (*e.g.*, Fuller, 1990; Rumar, 1990). Novices may not yet have developed effective attentional distribution and scanning, and perhaps may be missing memory templates for visual targets that should be fixated. (Attending to their peripheral vision, the driver might say, *"I should look at that blurry moving object off to the left, could be something that will move into the road, like a deer."*)

Night driving and its special visual requirements are a particular problem. Even if scanning properly drivers cannot detect a potential hazard if it is out of range of their headlights. It is clear that even many experienced drivers do not recognize the visual limitations of driving with headlight illumination only (*e.g.*, Leibowitz and Owens, 1986), and this needs to be clearly illustrated and linked to an appropriate feeling of discomfort at "driving blind."

Once a visual target is detected, the model shows it as passing to perception where it is recognized or identified.

Topic 4.1 Visual Scanning

4.1.1 Model mature scanning patterns under all conditions

Visual scanning reflects the spatial distribution of attention and proper scanning is critical to the detection of features of the roadway environment. Novices should be able to describe appropriate basic scanning patterns and rates, relate scanning to mirror use, and recognize effects of age and experience on scanning. On the road they should be able to narrate appropriate fixation sequences and identify situations calling for special scanning. They should have a basic understanding of the narrow distribution of acuity over the visual field and recognize the limitations and importance of peripheral vision.

Novices should also understand limitations of vision, such as obstructions and night conditions. They should be able to imagine what possible hazards might be in a threatening position but not yet visible, and they should develop a discomfort reaction to a situation where there is a possible hazard in a location where they cannot see it.

4.1.2 Demonstrate potential hazard detection

To detect and identify potential hazards, drivers must fixate on appropriate visual targets while scanning the environment. Novices should fixate and report potential hazards and narrate appropriate fixation and detection while driving, including peripheral and distant targets.

Topic 4.2 Detecting Path Deviations

4.2.1 Detect vehicle weave with peripheral vision.

Novice drivers need to develop automatic tracking control via peripheral vision to free up attention for other tasks and for scanning the distant environment. They should recognize effects of visual patterns on steering and speed control and be able to demonstrate a distant scanning center in narration while driving. They should be able to maintain lane position on straight and curved sections while performing secondary tasks.

4.2.2 Demonstrate "gut feel" sensitivity for incipient loss of control

Experienced drivers develop sensitivity or "feel" for the road surface and any untoward yaw or side slippage in their vehicle. Novice drivers should be able to describe visual and kinesthetic cues for skid detection and demonstrate increasing sensitivity to yaw and incipient side slip. They should demonstrate road surface feel and discriminate changes in surface texture and friction underway.

5. Perception

Perception consists of the mental processing of information from the senses. In the driver model it is the comparison of detected visual patterns to known patterns or templates, resulting in the recognition and identification of potential hazards. It is strongly influenced by expectancy – we tend to see what we expect to see. Perception of input from other senses beside vision – hearing, the acceleration detectors in the balance sense, and the muscle senses – are important in special situations and high-performance driving, but less so than vision in routine driving, especially for novices.

Perception involves adding meaning or understanding to the data detected by the senses. Perception errors include failure to recognize, or misinterpretation of, what is seen.

Unless it cannot be recognized and needs another look, a detected target is identified and stored knowledge about that type of target is added ("I know about how fast a running deer moves"). The model shows that additional information is provided by the driver's knowledge store, perhaps a sort of "template" against which visual input can be compared. (*"Yes, I recognize it now, that is a deer running toward the road."*)

Once a detected target can be recognized and its meaning understood, that information can be passed on to higher "thought" processes where it can be evaluated for risk.

Topic 5.1 Seeing with Understanding

5.1.1 Recognize limitations of perception

The driver is able to perceive only a small fraction of the information available in the environment, and it is important that this limitation be strongly recognized. Novices should understand the problems of visual obstruction, visual noise, and other factors in "looked but failed to see" errors. They should be able to describe weather, time-of-day and road conditions that affect perception. They should recognize that the human perceptual system has some fundamental design limitations (such as poor sensitivity to different closing rates) that can lead to serious errors and crashes. They should understand the effects of expectancy on perception – we see what we expect to see based on experience.

5.1.2 Demonstrate early identification of objects near roadway

Novice drivers are less able to identify distant objects that might be potential hazards. It is important for them to learn to recognize potential hazards at progressively greater distances, ahead and to the side, so that the risk can be evaluated earlier.

Topic 5.2 Potential Hazard Recognition

5.2.1 Demonstrate mature recognition of hazards while driving

Categories of potential hazards tend to be misidentified by novice drivers, with errors of underestimating and overestimating risk. Drivers need to recognize the effects of inexperience on hazard recognition and to learn more accurate recognition of risk presented by moving and stationary objects.

6. Evaluation

Evaluation of perceived potential hazards is needed to see if they are indeed hazardous, which depends on many factors, most importantly speed and distance (*"By gosh, I'm really moving and that deer is pretty close"*). Evaluation is a complex cognitive process, influenced both by knowledge and motivation, and strongly affected by impairments such as alcohol and fatigue. Experience-based knowledge is basic to evaluation – rules and principles are needed to predict outcomes, and these are built up mainly from experience (*e.g.*, Wilde, 1994b). Motivational states may also affect evaluations – for instance, if the driver is in a hurry or angry, a small gap in traffic may not look as risky. Critical errors result from the inaccurate evaluation of the risk presented by the perceived situation. This could result from lack of knowledge about likely outcome, or because of the evaluation being biased by some transient motivation or impairment. Errors also result from attribution bias, the tendency to see one's own errors as resulting from situational factors but the errors of others as resulting from some fundamental character defect.

The evaluation process involves analysis of the perceived situation, factoring in both the perceived hazards in the environment and the driver's relation to them: that is, the travelling speed, the distance, and the drivers estimate of ability to control the situation. Evaluation produces outcome expectations and passes them on for a decision as to whether the evaluated risk is worth taking.

Topic 6.1 Risk Assessment

6.1.1 Recognize effects of age and experience on risk assessment

Novice drivers should recognize the reasons for risk judgments and errors and be able to discuss novice drivers' under and over estimates of risk in different situations. They should be able to describe the effects of impaired states, motives, and emotions on risk assessment.

6.1.2 Model safe gap acceptance

Novice drivers often display risky gap acceptance. They should be able to define safe gap acceptance and perform cognitive skills related to it: 1) estimate and verify *time to impact* (closing rate) of oncoming vehicles under various conditions; and 2) estimate and verify *time to completion* of maneuvers in various conditions. They should be able to discuss effects of frustration on gap acceptance, and they should demonstrate safe margins in closing rate estimates and in estimation of the time needed to complete maneuvers, such as pulling out and passing, that depend on safe gap acceptance.

6.1.3 Evaluate high-risk collision contexts

Novice drivers need to better prioritize the contexts, situations, and actions that contribute to crashes. They should be able to summarize circumstances and actions from crash statistics, for their age group and for other high risk road user groups and recognize these circumstances on the road.

6.1.4 Personal limits in risk assessment

It is important for novice drivers to personalize their limits, particularly in evaluation of risk. Knowledge of general age/experience effects and possible reasons for them will not automatically lead to recognition that it applies to an individual personally. Insight is needed into reasons why young drivers develop overconfidence.

Novices should demonstrate ability to provide running risk commentary and accept feedback showing the limits of their risk assessment to enhance their ability for self-appraisal and self-monitoring. They should be able to identify personal causes and effects of underestimating of hazards and overestimating their own ability.

Topic 6.2 Others Road Users' Expectations and Perspectives

6.2.1 Consider others' point of view

A mature driver needs to be able to evaluate situations from the position of other road users. To predict the likely actions of others, drivers have to consider roughly what others can see from their positions, and what they are trying to do.

Especially important for novices is the ability to evaluate the expectancies of others. Many decisions depend on whether the chosen behavior will cause conflicts by violating the expectations of other drivers, pedestrians, and cyclists. Unusual speeds or maneuvers that might not cause problems on an empty road can cause crashes when other users are present. Novice drivers must develop an understanding of other users' perspectives on their own behavior and recognize the value of predictability. They should fully appreciate what others expect from them.

Topic 6.3 Attribution Bias

6.3.1 Recognize situational contributions to drivers' errors

Both emotional reactions and situation evaluations depend to some extent on what motives and reasons one attributes to the actions of other road users. Novice drivers should understand attribution biases and show insight into negative emotional effects resulting from bias. They should recognize the effects of distractions, emotions, and conditions on their own errors and the errors of others for which they might be required to take some corrective action.

7. Decision

In the assumed model, the driver's decision function receives the situation evaluation and chooses an appropriate action. It identifies and weighs optional courses of action, selecting and timing responses to optimize the driver's personal benefit/cost equations.

Even if a driver identifies a hazard, the driver's motivation will influence the choice or timing of action. Often a risk-accepting, inappropriate choice will result (*"I could brake now, but I'm in a hurry; it's only a small deer, and I'm driving a rented car – maybe I'll carry on, monitor the deer's progress for a few seconds, and see if it looks like it can clear the roadway"*). Since many potential hazards do not develop, one can learn to delay response until the situation is critical, and safe correction of the problem is no longer certain or even possible. Both the *choice of response and the chosen timing of response* are critical to the outcome.

Once a decision is made, whether the intention expressed in the decision is carried out depends on the driver's car-handling ability.

Topic 7.1 Option Matching

7.1.1 Recognize optional responses

Novice drivers should learn to describe optional courses of action and timing in response to situation evaluations. They should be able to discuss effects of age and experience on the available options.

Topic 7.2 Response Selection

7.2.1 Demonstrate ability to select an appropriate response in time-limited and high-pressure situations

Novices should recognize options in various situations of differing criticality. They should be able to discuss hazards of failing to take action in critical situations and the reasons why many crash-involved drivers do nothing. They should be able to narrate reasons for matching options to situations while under way.

Topic 7.3 Risk Acceptance

7.3.1 Justify personal level of risk acceptance

Novices should recognize factors that influence their own and others' risk acceptance. They should be able to assign appropriate value to deliberately risky driving actions, their own and others', and discuss "what you get for the risk you take." They should be able to narrate risk levels and relate actual on-road risks to target risk acceptance while driving.

Topic 7.4 Retry/abort

7.4.1 Recognize the need to keep trying if first choice response fails

A driver's first choice of response (for instance, straight-line braking) may not correct a risky situation. Novices should recognize reasons why first responses may fail and be able to mentally rehearse a hierarchy of responses in various situations.

8. Motor Skills

Drivers must have a certain amount of psychomotor skill to properly execute an intended action. They can make a right or wrong choice of actions, and either execute the choice correctly or not, depending on the degree of vehicle-handling skill (Wilde, 1994b). (*"Deer stopped on the road, have to brake and steer to avoid it"*) The required motor skills can develop over a very wide range levels, from the basic ability to steer and control speed to high-performance, stunt, and emergency crash-avoidance skills. It must also be recognized that drivers do not perform maneuvers alone, but depend on their vehicle's response. Motor skill involves sensitivity to vehicle response and the ability to gauge control during maneuvers.

Given that the driver's control action and the vehicle response occur as intended, the outcome will still depend in part on certain of the driver's earlier decisions.

Topic 8.1 Controlling Acceleration and Speed

8.1.1 Demonstrate accurate throttle control

While styles differ even among skilled drivers, vehicle handling skills can be influenced by a driver's postural and positioning choices in the vehicle. Novices should be able to define and adopt an effective foot position for throttle control. They should know the benefits of smooth acceleration and steady cruising speeds. They should be able to display smooth, low-jerk accelerating from rest, low throttle reversal rates, and low variation in cruise speed.

Topic 8.2 Controlling Deceleration

8.2.1 Demonstrate optimal routine deceleration/ braking

Novices should learn the benefits of early and gradual deceleration and practice it with due consideration of the expectations of following drivers. They should be able to modulate steady light braking and display jerk-free stops They should demonstrate producing and holding a complete stop on different grades and be able to define the purposes of parking brakes.

8.2.2 Model smooth time-limited braking

A somewhat higher-than-routine level of braking performance is often required, as when a signal light changes during approach or some path blockage is perceived a little late. Novices should be able to use the brake with different and appropriate levels of moderate impact. They should be able to perform smooth moderate-severity stops and check to the rear for any threat from oncoming vehicles. They should understand reasons for rear-end collisions and identify means of evading rear-end impact.

8.2.3 Demonstrate optimal emergency braking control

Proper seating position is of some importance for application of heavy brake pressure, and this should be understood and practiced by novices. They should be able to define threshold braking, outline the reasons for its use, identify cues for incipient lockup, and display precise modulation of brake pressure near the threshold of wheel lock.

Locked wheel braking may be appropriate in certain circumstances, such as a panic situation, to scuff off speed before evasive steering, or in a skid that has progressed beyond the point of no return. Novices should be able to make high initial pedal impact and hold the lock. They should be able to discuss reasons for using or avoiding locked wheel braking. If locked wheel braking is practiced it should be combined with demonstrated ability to release and steer.

As anti-lock brakes become universal, wheel lock and thresholds become of little concern to drivers, but appropriate knowledge and skill for obtaining maximum output from these systems will be needed. The benefits and limitations of anti-lock systems must be clearly understood to avoid the possibility of overconfidence in their capabilities.

Topic 8.3 Steering

8.3.1 Display full range steering control

Novice drivers should develop consistent seating and hand position styles that permit quick and precise steering control. They should be able to demonstrate smooth steering responses while both turning in and unwinding the steering.

8.3.2 Display steady lane tracking

Novices should recognize optimal lane positions relative to situations. They should display low weave rates and little unintentional variation in lane position, and display a low steering wheel reversal rate.

Topic 8.4 Skill Integration

8.4.1 Show ability to start, accelerate, turn, backup, and stop smoothly

For novices to reach reasonable levels of vehicle handling requires a smooth integration of quite a number of separate skills. They should be able to identify reasons for seeking smoothness in various conditions and to recognize errors. They should practice smooth accelerations (low jerk) in all axes.

Topic 8.5 Error Correction

8.5.1 Demonstrate or describe skid correction

Low-friction surfaces can lead to some side slip or skidding even within normal levels of speed and maneuver severity, perhaps even for drivers who are adequately motivated to try to maintain wide safety margins. Novice drivers should be able describe the causes of skidding, detect incipient wheel slip, and describe appropriate responses. They should be able to restate that the occurrence of a skid means that an error has already has occurred, and that error correction is uncertain of success. Rapid and precise steering response is needed to correct skidding, and novices should be able to discuss seating position and alternate steering wheel hand positions that facilitate this steering. They should understand the principles of skid correction and that a rolling wheel provides directional control. Steering into the skid and minimizing drag on the wheels by releasing brakes and shifting to neutral, should be understood. They should be able to integrate the required control movements, including the normally unfamiliar one of shifting to neutral.

Visual requirements for skid correction should also be recognized. Novice drivers should know that steering follows eyes and be aware of how to keep their eyes up and looking in the direction of desired travel.

When a vehicle in a skid has rotated beyond the limits of possible recovery, it may be helpful to lock and hold the brakes, to permit the car to travel in a straight line and avoid regaining enough traction to alter direction sharply or roll over. Novices should be able to define the "point of no return" in a skid and relate reasons for lock up as a last resort when correction attempts have failed.

8.5.2 Demonstrate evasion skills

Novice drivers should recognize error correction situations requiring emergency evasion maneuvers. They should understand the principles of, and be able to demonstrate, wheels-off-road recovery, head-on collision avoidance, and rear-end collision avoidance.

9. Safety Margin

Perhaps the most critical of all the driver qualities is choice of safety margin. This choice is the result of a decision process that usually takes place at some time ahead of any obvious hazard or risky situation, under what is seen as routine, normal conditions. It is in effect a preparatory response for possible situations that cannot yet be seen but must be "imagined." It is therefore a rather abstract idea, and it is especially difficult for novice drivers, who appear to be more bound by what they can actually see, lacking the experience to know all the possible hazards that could appear unexpectedly. Choosing a safety margin involves managing the time and space available for detection, perception, evaluation, decision, and response. Safety margin is controlled primarily through choice of driving speed and placement of the vehicle. The amount of time and space available will determine if an intended action can be successful, and if there is time to try something else if the first choice seems not to be working (*"I'm not going to stop in time, better steer around"*). The outcome of the situation and the driver's response also depends, of course, on other factors outside the driver's control – environmental factors, other road users' actions, etc. Outcomes of all sorts provide feedback to a sort of rational executive, or conscience function in the driver.

Topic 9.1 Speed Choice

9.1.1 Model speed choice that provides safety margins

Novice drivers must commit to proper and moderate speed choice. To do this they have to recognize the effects of excessive travelling speeds on error correction time (their own and others' errors), which can be critical even when the travelling speed seems acceptable. They should be able to discuss reasons for personal speed choices and outline factors/ conditions leading to variation in speed choice.

Topic 9.2 Separation

9.2.1 Maintain safe headways and lateral separations

To commit to proper headway selection in all conditions, novices must be able to identify when they are too close to the vehicle ahead at all speeds, calculate effects of headways on available error correction time, and understand the implications of short headways. They should be able to describe the principles and benefits of creating safe lateral separations.

Topic 9.3 Early Response

9.3.1 Avoid delayed response to detected potential hazards

To better understand the need for commitment to early response novice drivers should be able to calculate the total time to respond to a road event requiring an evasive maneuver, recognizing the time and distance needed for decision and response. They should be able to narrate reasons for preparatory response timing while driving.

Topic 9.4 Contexts and Conditions

9.4.1 Commit to safe margins in all conditions

Many situations – distractions, emotions, other road users' errors – can lead to compromising safety margins. For novice drivers, passengers seem to be a major risk factor, and novices should recognize the effects of passengers on their driving and take steps to prevent adverse effects. They should be able to manage the effects of time pressures and other personal conditions on their maintenance of safety margins.

9.4.2 Adapt driving practices to all external conditions

Novices should recognize external conditions that lead to compromised safety margins and adapt to traffic, roadway, and weather conditions.

10. Responsibility

Responsibility is defined as the driver's conscience or management function. It is the set of internalized norms that influences of individual motivation. It helps energize and direct behavior that serves some goals beyond the immediate and individual. Responsible driving requires a focus on risks and possibilities beyond what the driver can see at any given moment – in accordance with an imagined model of what might be about to occur. Responsible driving also requires a commitment to helping meet social objectives beyond that of the individual – acting in accordance with good practice based on risks identified over whole communities, even if the risk seems too small for each individual to worry about. Individuals are most likely to take on this sort of responsibility when they are persuaded or induced to become active in promoting it, as in Geller's (1991) active caring model, or as "transmitters" of persuasion (Parker *et al.*, 1992).

Responsibility also requires the ability to assess one's own performance on the road and to keep it in line with personal and social values. The driver quality we are calling responsibility provides the basic self-correction and self-control needed for safe, mature, efficient, and socially responsible use of the roads. (*"That was close, I should have slowed down as soon as I saw that deer. Next time I will."*)

It is likely necessary to maintain a high level of all of these qualities in order to maintain a safe level of driver performance. There are legitimate questions as to whether they are all "trainable," even though they all can probably be influenced in some systematic way. As Wilde's (1994b) definitions suggests, this may be what we mean by education, as opposed to training.

Topic 10.1 Self-monitoring

10.1.1 Monitor the impact of own driving behavior on other road users

To commit to self-monitoring, novice drivers should be able to differentiate between assertive and aggressive driving and explain cues for evaluating performance. They should understand effects of impaired states on self-monitoring. They should practice verbal self-feedback and carry out checklist/feedback exercises with their parent/guardian.

Topic 10.2 Internal Conditions

10.2.1 Commit to driving unimpaired

To commit to avoiding impaired driving, novices should be carrying out impaired driving avoidance plans that they have developed themselves. They should be able to explain values concerning driving impaired, discuss alternative methods of avoiding impaired driving, and contract to take responsibility for their own and their peers' wellbeing.

Topic 10.3 Conflict Avoidance

10.3.1 Commit to respecting others' safety margins

Driving conflicts result when safety margins are compromised. Novices should recognize the importance of predictability and expectation in interacting with other road users.

10.3.2 Commit to conflict/crash avoidance regardless of fault

Novices should internalize the certainty that other drivers will not always do what they should. They must understand the frequency of drivers' errors and recognize the mutual responsibility to help correct errors. They should be committed to avoiding conflicts and crashes regardless of other road users' errors and "fault."

Topic 10.4 Seat Belts and Child Safety Seats

10.4.1 Commit to promotion and leadership in restraint use

Despite improvements in passive restraints, use of active seatbelts and child safety seats will remain critical to safety. Novices should be able to summarize biomechanical benefits and limitations of active and passive occupant protection. They should influence friends to use safety restraints.

Topic 10.5 Active Caring

10.5.1 Adopt active commitment to community safety

Novice drivers themselves can become a force for safety improvement, and they will benefit in safer behavior themselves as well as growth in self-esteem and numerous skills in the process. Peer teaching and participative education are powerful, two-way influences. Novices should discover the national and community cost of crashes and the potential personal, social, and economic impacts on themselves and their friends.

10.5.2 Accept need to be a leader to improve health and safety

Novice drivers should be given opportunities and resources to organize opportunities to provide safety leadership. They should be able to discuss with peers the need to change the world and be a leader. They should volunteer time to youth/community organization and identify ways to support community safety programs.

10.5.3 Commit to positive role modelling

Novices need to develop confidence and express self-efficacy for making a positive contribution to responsible driving. They should recognize "error contagion" and considerate driving, and value providing a positive model for others.

Topic 10.6 Communication

10.6.1 Commit to positive and helpful communication

Novice drivers should understand the nature and impacts of positive and negative communication among road users.

10.6.2 Show readiness to use direction signals and warning flashers

Novices should be able to describe appropriate uses of signals and reasons for use. They should demonstrate direction signal use at every appropriate opportunity. They should be able to explain reasons for always signalling and relate them to expectations.

Topic 10.7 Energy and Environmental Conservation

10.7.1 Use less fuel per driver and per unit distance

Novice drivers should recognize long-term transportation energy conservation needs and value conservation. They should demonstrate fuel-efficient driving skills.

10.7.2 Commit to minimize environmental costs of driving

Irresponsible vehicle use and maintenance can extract a high environmental cost. Novices should value respect for equipment and facilities, and be able to outline life cycle costs of vehicles and parts and environmental costs of vehicle use.

SECTION 3 SUMMARY

- The driving task is sufficiently different from scholastic subjects that it requires a unique objectives structure.
- Curriculum resources need to be driven by these objectives and organized according to their structure.
- DE's goals can be achieved only by developing a wide range of "educable qualities" in novice drivers. Ten critical qualities are identified:
    1. Motivation
    2. Knowledge
    3. Attention
    4. Detection
    5. Perception
    6. Evaluation
    7. Decision
    8. Motor Skill
    9. Safety Margin
    10. Responsibility
- The objectives structure derives from the Educable Qualities:

    X. Educable Qualities

    X.x. Topics (clusters of related objectives)

    X.x.x. Performance Objectives (desired driving achievement)
- The performance objectives are focused on:
    1. improving novice drivers ability to better perceive and evaluate the risks they face while driving; and
    2. reducing the amount of risk they are willing to tolerate on the roads through individual motivation and social responsibility.

4. METHODS

4.1 SHAPING THE METHODS TO THE GOALS

While it is beyond the scope of the current project to develop specific curriculum units, this section is intended to guide curriculum development and evaluation in directions that will improve their safety effectiveness. To actually achieve lasting safety effectiveness may require intensification and refocusing of limited resources, particularly teacher time.

Achieving DE's safety goals will be the result of the application of curriculum resources delivered through a substantial educational and influence infrastructure. The curriculum resources and other influences need to be driven by the objectives and organized according to the objectives structure (Robinson *et al.*, 1985).

Driver education methods have traditionally centered around textbook and lecture transmission of knowledge, with 25-30 classroom hours being typical. This is supplemented with limited instruction, observation, and supervised driving practice on the road, typically between 6 and 10 hours. Some DE programs have included range driving or driving simulators of various types.

There are two principal trends currently emerging that will move DE away from its traditional methods:

1) More participation and group work by the students in the classroom; and

2) Individualized, computer-based, interactive multi-media presentations.

Greater efficiency in the mastery of driving abilities is critically important for DE's future safety impacts. There is a need to free teacher resources to address the driver qualities of higher safety criticality – motivation, decision, and responsibility. The need for and possibility of these trends is not new – they were identified in the Automotive Safety Foundation's *Resource Curriculum* for driver education, developed by Richard Bishop and others in 1970, and summarized as follows:

> *Before Driver and Traffic Safety Education can hope to modify the behavior of young people, teachers must become more than dispensers of information and trainers of skills. Information and manipulative skills alone do not produce proficient drivers. Learning needs to have personal meaning if students are to behave differently. To facilitate meaningful learning, teaching demands competency in providing situations that encourage students to (1) examine and clarify their feelings and values, (2) explore alternative forms of behavior and related consequences, (3) make and try out decisions in new situations and (4) formulate generalizations. For best results, students need to participate actively in these higher forms of learning. In short, information and skills must be taught in such a climate that students see and accept the responsibilities associated with the learnings (ASF, 1970 p.162).*

Different people have different preferred learning styles. They may be more or less efficient in learning through the different sensory modalities and instructional structures, such as listening to a lecture, watching a video, reading a textbook, planning and building a demonstration model, group problem solving, or interacting with a computer, among many other options (Gagne & Briggs, 1988). A desirable innovation in DE will be to have optional media available so that different students can use the medium that best suits their needs. The highest-risk young drivers may be the very ones who learn least well through conventional lecture/text methods.

The highest-risk young drivers may also have low self-esteem, low self-control, low social responsibility, and irrational beliefs (Rolls and Ingham, 1992). Social responsibility and the intrinsic motivations for self-worth, task mastery, autonomy, and self-control are critical to the achievement of DE's safety goals. Therefore DE should both target the growth of these qualities and **provide opportunities for practicing them** in the curriculum (Caine & Caine, 1994). Self-pacing, diagnostics, frequent performance feedback, rewards for process effort and interim accomplishments, and a certain amount of self-direction and group goal planning should be *included. Participation in goal setting will help* maintain learning motivation along the way (as opposed to the overriding motive of obtaining a driver's license). Group work will help consolidate rational peer influences (Kay, Peyton, & Pike, 1987).

While it may be desirable to avoid the "crash and burn" atmosphere of the more lurid computer games, computer-based instruction promises to be useful for DE. Multi-media resources can facilitate self-paced learning, by providing equivalent optional paths through the learning process, with ongoing diagnosis, evaluation, and feedback. Self-pacing and diagnostics can give "advanced standing" to those who enter with greater knowledge and skills. Those who learn faster can progress rapidly, keeping up their motivation and reaching higher levels of achievement. Some high-risk young drivers are also among those who come to DE with a great deal of knowledge about, and interest in, cars and driving (Rolls and Ingham, 1992), which may even override other social and economic values in their personal utility calculations. It is not helpful for DE to bore these students.

There is a resource tradeoff required between the training of driving skills and the attempt to develop the personal motivation and social responsibility that ultimately determine safety. While these very different objectives may require quite different means, the most successful programs may well be those that find ways to make some of their instructional resources serve both ability and motivational objectives. While looking for opportunities for double impacts, we will initially address separately the means of influencing what drivers can do and what they choose to do.

Method Issues in Training Skills and Knowledge

Sequence of Instruction

Key to the success of the skills and knowledge portions of DE is the mix of classroom and lab instruction, part-task practice, and actual driving. In the past, instructional sequencing has been a matter of meeting the logistical needs of the school or instructor.

In the practical matter of managing the novices' on-road driving experience, the OECD (1981) listed maneuvers in ascending order of degree of difficulty as follows:

1) Moving off, driving straight ahead, and stopping
2) Passing parked cars or other objects
3) Meeting oncoming traffic
4) Overtaking
5) Turning right
6) Crossing (driving straight ahead at crossroads)
7) Turning left
8) Merging and separating (entering and leaving freeways)
9) Driving in dense traffic (bumper to bumper and side by side)

In the modern driver education/training course, sequence will be decided in terms of effectiveness of the instructional process. Instruction (the imparting of information) should lead directly to practice and test and then to vehicle operation activities tied to the performance objectives. Different curricula will be used in different jurisdictions to correspond to their licensing and DE structural requirements. As discussed further in Section 7, these curricula will need to have sufficient sequencing flexibility to deliver "just in time," individualized instruction.

The Objectives

Driving is a complex mix of cognitive, perceptual, and psychomotor tasks. Novice drivers must learn to integrate these various tasks into smooth, safe performance. In the past, the approach to driver education has stressed the acquisition of fundamental driving knowledge in the classroom and the acquisition of fundamental driving skill during on-road vehicle experiences.

An underlying assumption of this development is that the acquisition of knowledge is a necessary but not sufficient step to driving competence. The knowledge must lead to skill; knowing how long it takes a vehicle travelling 55 mph to stop is not the same thing as stopping a vehicle travelling 55 mph.

Therefore, performance objectives are achieved through activities that challenge both knowledge (for example, sketching the trajectory of a skid under various road and weather conditions) and skill (identifying instances of following too close by looking at static or dynamic representations of out-of-windshield views).

Objectives must also be designed to be independent of a specific medium or technique, as far as is possible. Objectives may require specific conditions, however. For example, an objective may require the student to locate the point of sustained focus in an out-of-windshield view during a skid. In the simplest manifestation of this objective, the student would be shown a series of photographs and would denote the point of focus with a pencil or pen. In a more advanced manifestation, the student would be interacting with a computer-generated video image and responding by positioning a cursor with a mouse or trackball.

...knowing how long it takes a vehicle travelling 55 mph to stop is not the same thing as stopping a vehicle travelling 55 mph.

Drivers must constantly make judgments based on visual information. Learning the safe distance for following another vehicle is different from recognizing that distance when it actually presents itself. Therefore, one obvious area for development is visually based materials that will allow a student to (1) acquire the visual information needed to make driving judgments, (2) practice with feedback and, (3) be tested against some agreed upon criterion.

In the curriculum outline that follows, there are numerous references to visual displays of through the windshield views of various environmental and situational events. In some instances, a "bird's eye view" is also mentioned.

The ideal medium for such material is a computer-based, interactive, high-resolution graphic system. Such a medium could be CD-ROM, interactive video disc (IVD), one of several competing computer gaming systems, or even a state-of-the-art computer graphics system. The good news is that the early stages of developing such a program do not require a commitment to any single one of these systems. In fact, a systematic approach can produce a validated driver training program without risking a commitment to a single technology.

This comes from the need to approach all computer-based training in the same way:

(1) Identify the tasks for which the training is to be developed.

(2) Finalize the precise description of the criterion behavior.

(3) Develop a storyboard for the entire training, including all branching options.

(4) Develop a script.

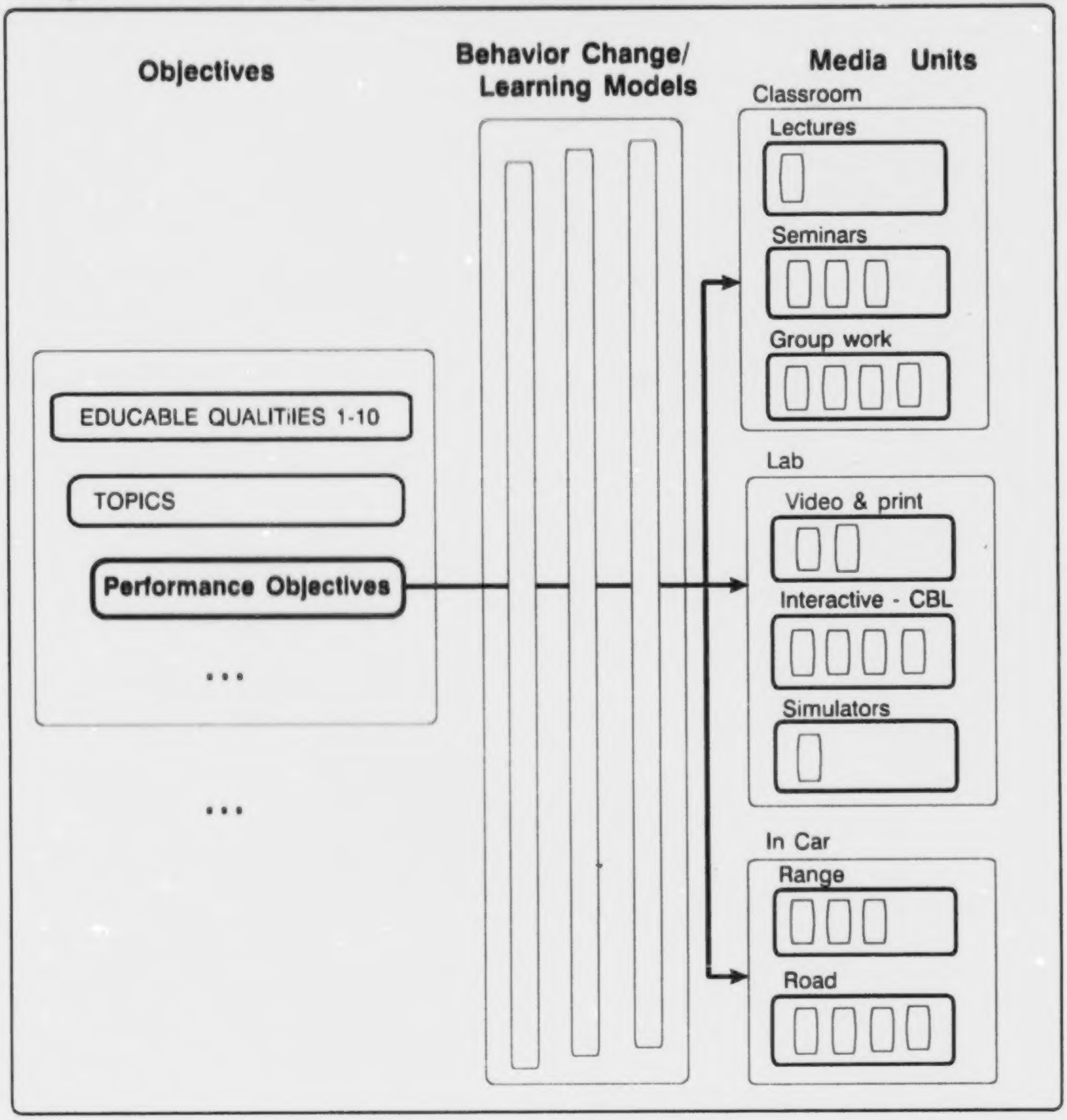
(5) Produce a video containing all the elements prescribed above (this production also has several steps).

The resulting videotape contains not only all the visual elements of the training package, but the instructional ones as well.

(6) Validate the training (have students take the training to discover video, process, and instructional errors).

The validated instructional video tape can serve as a stand-alone package (with accompanying documentation). It can also serve as the video for whatever media are selected for final product development.

Figure 4-1 Building Instructional Media Units


Objectives
Behavior Change/ Learning Models
Media Units
Classroom
Lectures
Seminars
Group work
EDUCABLE QUALITIIES 1-10
TOPICS
Performance Objectives
...
...
Lab
Video & print
Interactive - CBL
Simulators
In Car
Range
Road

4.2 BUILDING INSTRUCTIONAL MEDIA UNITS

Figure 4.1, *Building Instructional Media Units*, suggests the relationship between specific objectives and specific media units. The units indicated are intended to illustrate the principles involved and as a basis for discussion – the actual number of units of each type will be left to curriculum developers to decide, based on resources available and other local considerations.

In few cases will objectives and media units map one-on-one. Most objectives will appear in more than one unit and most units will address more than one objective. The process for translating objectives into instructional media units involves passing them through a filter consisting of the models and theories of behavior change Traditionally this filter would have consisted of pedagogical theory or practice, but we believe that this is too narrow to produce an effective set of units. A full range of models should be considered as potentially effective instructional units that affect behavior rather than just improving skills and knowledge. Lonero *et al.* (1995) provided an overview of cognitive, behavioral, economic utility, social marketing, diffusion of innovations, and various health promotion models for influencing road user behavior. There is no one model of behavioral change that can serve all needs, any more than one model of driver behavior can comprehend the full range of behaviors.

The most comprehensive theory or model of individual behavior change with a specific road safety application is Geller's *Intervention Impact Model* (Geller *et al.*, 1990; Geller and Ludwig, 1990). This model analyzes the motivational strengths of behavioral interventions, including but not limited to educational interventions. This model can provide a checklist for the curriculum developer trying to estimate the behavioral impact of curriculum units, particularly those with a motivational component. Behavioral influences and Geller's model are discussed further in Section 6. Geller's research and the resulting model support the strengths of methods that involve high levels of involvement, social support, and information, as well as providing incentives or disincentives. Given the importance of motivation in the safety outcomes of novice drivers, it is crucial to consider the motivational impacts of the educational experiences provided to DE students.

4.3 INSTRUCTIONAL DELIVERY

Performance objectives determine the tests that the student must pass to advance to a new instructional experience or graduate from the training program. Clearly, using the proposed methods and technologies just for performance testing would be inefficient. The assumption implicit in the objectives is that the same media and techniques will usually be used for instructional purposes as well.

In a truly automated, individualized instructional program, each student progresses at his or her own best rate until some criterion is met. The objectives prescribe that criterion. An effective instructional program would have the student practice the prescribed performance (e.g., sketching trajectories) until criterion performance is reached. From the student's point of view, the shift from practice to test would be seamless.

Even in non-automated, less individualized settings, this strategy can hold. An instructor who requires students to decide when a photograph reveals an instance of following too close should not rely on traditional text to prepare a student for such a test. The instructional material must also be pictorial and, therefore, more realistic. In this example, the student is learning what "too close" looks like; the test verifies the student's accomplishment of this learning.

As discussed above, Wilde (1993) has proposed a concrete method for assessing hazard perception of learners and providing feedback on it. He proposed a technique similar to "commentary driving." Instead of reporting everything perceived, the student would give ongoing ratings of the level of collision risk perceived while driving. Errors in potential hazard perception and risk evaluation perception could then be corrected.

Instead of reporting everything perceived, the student would give ongoing ratings of the level of collision risk perceived while driving.

Simulation

The current state of the art in driving simulation does not give hope that realistic, full-task driving simulators will offer cost-effective solutions to driver training any time soon. Those simulators that might act as a bridge between classroom and vehicle are both extremely expensive and lacking in realism. Less expensive simulators which provide simulation of specific activities within the driving repertory, are also expensive and may not be interactive.

While many driver performance objectives could benefit from more intensive simulation, it does not seem practical in the short term to rely on such interventions to be either technologically or financially feasible. It is clear that many of the objectives leading to driving ability could best be acquired under simulated driving activities, but these will have to wait for longer term technical development. We would avoid calling for extensive simulation with these objectives. An underlying premise of this development is that the objectives should be able to be met in the short term without expensive interventions by advanced technology. In the middle to longer term, simulation of the whole driving task or significant portions may be economically feasible. In the meanwhile it is worth looking for economical opportunities to use computer based learning of portions of the task and the underlying abilities.

Need for an Eclectic Approach to Instructional Design

There are many potentially relevant models or theories of instruction that could provide guidance to DE curriculum developers. We might take on one particular model and work with it exclusively, but we believe that this would likely be a formula for failure. It is our view that driver education is fundamentally different from the academic disciplines around which most instructional theory has been developed. The bottom-line performance goal of driver education is nearly unique. Even health education, which is perhaps the closest comparison, would rarely be evaluated on bottom-line outcomes. Furthermore, the complex and powerful set of influence factors that DE must overcome to meet its goals is also rather unique. Driver education needs its own model, because it really has to be stronger in its impact than other school subjects in order to fulfil its extraordinary missions. To achieve this strength it will have to borrow from the relevant strengths of diverse educational and other influence approaches.

Adult Education

One model that we might look to for guidance is adult education, which appears to have many of the attributes needed for effective DE. The OECD's 1981 *Guideline for Driver Instruction* states: "Driver instruction is directed at adults. Hence it follows that the organisation of instructional content and choice of methods must be in accordance with what is known about adult education" (p.13). While this assertion is likely based on the European situation, where the minimum driving age is typically 18, many of the methods in use by adult educators can likely be successfully used with DE students – both with older adults returning to formal education, and with senior high school students. The relatively new field of adult education does not hold a single conceptual framework, and might best be described in terms of its difference from traditional pedagogy. Traditional assumptions about students are that they are passive, they bring a blank slate to the classroom, which needs to be "filled," they are inexperienced, and they operate from external motivation, such as parents or grades. Furthermore, conventional pedagogy uses transmission teaching foremost, including lectures and assigned readings, and teaches a prescribed subject content.

Adult education differs in its assumptions about the learner, who is seen as self-directing, full of knowledge and experience that shape learning, and operating from internal motivators, such as self-esteem, quality of life, or self-actualization needs. Consequently, adult students often have a "need to know," and are generally task oriented, wanting to solve practical problems (Knowles, 1984). As one writer describes the shift:

> *…ex-cathedra lectures, set tasks, and conventional lessons have gradually been replaced by group work, group discussion, and the exchange of experiences… Perhaps most significantly, the teacher has been succeeded by the animateur [or facilitator] whose function is not to transmit knowledge but to render the adults in his or her charge capable of seeking, questioning, and utilising personal experience and documentation. (Lengrand, 1986, p. 9).*

The implications of an adult education orientation for a DE curriculum and DE instructors are that courses will require more flexibility in structure to meet the individual needs and greater experience of adult learners. Even students in their mid-teens may have a surprising amount of experience with automobiles, and may themselves have driven before. Adult education often focuses more on the practical, with more feedback and less theoretical emphasis, to meet adult learners' preferences. Certainly, the benefits of small group work, including discussion or problem solving projects, have been clearly demonstrated (Darkenwald & Merriam, 1982). Geller and Ludwig (1991) found that discussion and consensus building have strong, long-term effects on behavior. Curriculum developers will likely find that DE is particularly suited to many of the contemporary methods of adult education.

Even students in their mid-teens may have a surprising amount of experience with automobiles, and may themselves have driven before.

4.4 REFOCUSING DRIVER EDUCATION RESOURCES

Curriculum time and space are needed for shifting DE's focus toward motivation, and more efficient teaching of abilities could help provide this time. It will remove teachers from the more mechanical parts of the training and allow them to concentrate on facilitating development of motivation and responsibility.

Freeing Up DE Resources (and Cognitive Resources) to Nurture Responsibility

Three important areas need to be emphasized in the DE curriculum. First is the mastery of key tasks to release "brain resources," that is, to reduce the amount of attention and information-processing capacity that they require. This could make more resources available for higher level decision tasks (Sulzer-Azaroff and Mayer, 1991; Schneider, 1985). The term "mastery" here is used rather than the learning psychologist's term "overlearning," which means that further practice on a task does not lead to significant further improvement in performance – performance has reached the flattened portion of the learning curve. Second is influencing the higher levels of the affective domain in order that new learning will be integrated into the student's value system (Krathwohl, Bloom, and Masic, 1964). Third is helping the student to become a trained self-motivator and self-evaluator in order to continue learning (Sulzer-Azaroff and Mayer, 1991; Skinner, 1968). These areas require a broad spectrum of teaching methods.

The behavioral benefits of participative education for some road safety issues have been shown by Geller in various settings. As discussed above, there is an emerging trend to more participative instruction in DE. For example, a director of a substantial commercial DE operation pointed out that lecture presentations are especially inappropriate for DE, because most students enter the course knowing a great deal about driving, at least by their own reckoning, and they are easily bored by lecture presentation. These schools use classroom time more for group work. Basch *et al.* (1987) found that young drivers strongly supported the value of peer discussions.

The second emerging trend in DE is toward interactive microcomputer-based, multi-media presentation. This trend also can help free up teacher time. Theoretical and factual components of knowledge items, for instance, seem a poor use of teachers' in-class time. Computer-based multi-media approaches present exciting opportunities for part task simulated practice, perceptual learning, diagnostics, and more individualized content and pacing for DE students. Some relatively subtle driver skills, such as distribution of attention, may be trainable in game or part-task simulation programs (*e.g.*, Gopher, 1992; McKenna and Crick, 1992). While there are difficulties in trying to simulate the whole driving task on small platforms, many objectives likely could benefit from microcomputer based interactive media.

...young drivers strongly supported the value of peer discussions.

Task Mastery

Many task components can be mastered through simulation on computer technology. As CD-ROMs, interactive laser videodiscs, and successor technologies evolve, the realism and levels of simulation economically possible will increase. By moving as many component tasks as possible to the computer, including even difficult evaluation and decision tasks, the student will gain expertise without increasing the expensive one-on-one in-car training. Key sub-components can be mastered alone first, then in increasingly complex configurations (Fiedorwicz & Trites, 1990; Schneider, 1985). For example, estimating stopping distances could be initially practiced at low (simulated) speeds, good light, and good road surface. Then, when success is achieved, conditions could be gradually changed one at a time and then in combination until the student makes good judgments even at high speeds, in poor light, and on tricky surfaces. Once this skill is fluent, simulated visual and auditory distracters, such as music, conversations, and traffic could be gradually added until performance levels remained consistently high in their presence.

With automated help students can progress at their own pace toward mastery before attempting tasks in a real-life setting. Students may have facilities at home or at local schools and libraries to work outside of class hours. As well, tracking for assistance and remediation is facilitated with a computer managed system. Multi-media systems allow for more realistic simulations than textbook and lecture, and they can support interaction, unlike film and video. Because they contain both auditory and visual lesson modes, they reach students with either preferred learning type.

In computer-assisted learning, many programs currently use one-to-one reinforcement, giving feedback for every correct response. This pattern should be optimised for DE to: 1) make correct responses more resistant to extinction; and 2) to model learning schedules for students to adopt for their own behavior maintenance. For instance, as a student becomes more adept at a task, instead of the program congratulating them for each item, it should gradually increase and vary the number of correct responses expected before a reinforcing message is issued (Sulzer-Azaroff and Mayer, 1994, 1991; Skinner 1968).

4.5 EDUCATING MOTIVATION AND RESPONSIBILITY

Motivational objectives require explicit planning and deliberate application of effective methods. They cannot be achieved as incidental benefits from driver skill training, as had been suggested by the OECD *Guidelines* (1981). There has been progress in understanding and influencing motivation since 1981, of course, mostly in fields other than DE. Experiences in health education and promotion, industrial safety, moral and values education, and other fields can be transferred to DE.

Again, need for integration of motivational issues with DE was recognized 25 years ago by Bishop and his colleagues, who wrote,

> *... a value results from activation of both cognitive and affective domains, the linking of thought and knowledge with feelings and emotions. Teachers sometimes talk about changing attitudes and values as though the process occurred in a vacuum apart from any subject matter. Valuing goes along with content. The value must be toward something, and, to understand something so that a value can be placed on it, the person uses his intellectual abilities to evaluate information about the object, person or situation. In short, value issues act as coordinating concepts for most subject matter and provide a kind of substructure in the curriculum (ASF, 1970 p.148).*

To reach the higher levels of the affective domain in teaching, students must be shown how to organize their own value systems and then integrate new responses. Further, they must have the opportunity to practice the use of these values until they become characteristic behavior. This motivationally oriented

DE will require a departure from traditional DE lecture/text methods in some areas. In particular it could alter how the teacher spends their time in the classroom, becoming more of a process facilitator and less a channel for routine factual information.

Subordinate Objectives

Many component skills can be learned with well-written computer software which could let the student build cognitive and affective values in a private, non-threatening way. In a classroom situation, students might be embarrassed to admit that they would drive after drinking, or that they do not know the effects of alcohol on judgment. By exploring these areas on their own, students are not forced into a stance that they may feel has to be defended. By using an intelligent tutoring system, students could progress at their own rate with training individualized to their needs and interests, and be less affected by variations in teachers (Winne, 1989).

Immediate and realistic feedback about the physical, financial, and emotional effects of their choices in a non-judgmental way would also enhance affective learning (Kay *et al.*, 1987). After a poor decision, the student would learn how much her collision would cost, how it would inconvenience her in terms of phone calls and repair time, how long she would need physiotherapy, or what her mistake cost her friends and community in human and economic terms.

Teachers

For the higher level affective objectives, group discussions and other group work will be a necessary component and should be facilitated by a teacher with life-skills or social-skills coaching abilities. For students to have a chance to integrate a newly acquired value, for instance, disregarding peer pressure to drive after drinking, they must first understand how their value system currently stands with regard to peer pressure. Then they would need to re-structure the current system with this new value in place. They would plan how to bring this into their behavioral repertoires so that they could form a habit, and eventually, a characteristic (Krathwohl *et al.*, 1964; Robinson *et al.*, 1985). This type of teaching might be done by a separate instructor, or by DE teachers with training in this area. Positively valued (by the target age group), well-known role models would be a definite asset for the video and audio portions of the values curriculum (Glover & Bruning, 1987; Rathus, 1988).

Peer trainers and coaches should be used wherever possible (Bell *et al.*, 1991). Creative techniques, such as the use of group challenges, or creating a new standard of what is "cool" would have better results issuing from a peer. In addition to having potentially better influence, peers provide a logistical benefit as well. An OECD report (1986) on safety education in general suggested that acceptance by teachers and other potential delivery agents is so difficult in many cases, particularly in secondary schools, that it would be better to train special "mediators" or approach targets directly through broadcast media, closed TV networks, etc. This may be less true of driver education than of safety education generally, but maximizing use of peers should be pursued strenuously. This is both because it can maximize the effect of limited teacher resources and because it is likely to be highly effective.

Parents

A large majority of the driving practice will be done with a parent/guardian rather than a DE teacher. Parent training must be encouraged in order that parents understand and maintain value-based behavioral expectations for their protegees. If the student has learned to value meeting other drivers expectations by signalling lane changes, the parents must not discourage this based on their own values. They may also need remediation in the area of role modeling. Since risk assessment and decisions will differ for experienced drivers, all parties must be aware of the complications of social learning in this setting. For example, if parents make a decision to overtake based on assessment of risk factors, students must realize that they would not necessarily make the same decision in that context since they are less experienced at judging distance and acceleration. At least one major parent-education package is under preparation at this time, and this will remain an important area of development.

Units in many of the media would also be appropriate for the parents, although independent usability at home would be a major asset. Print materials and videotapes would have good familiarity and usability, but a high and rapidly growing proportion of baby-boomer parents will also have computer access and skills and CD ROM multi-media capability. While access to current state-of-the-art microcomputers at home is likely to remain a minority proposition, within a few years the installed home computer base will likely be sufficient to use multimedia materials. Compatibility with existing systems should be considered an important feature of any computer based materials, particularly those intended for possible home use. Background information on novice drivers' risk factors and their training and supervision needs should be probably presented factually – emotion may be running high in these parents already. Techniques for providing feedback during training and later supervision and discipline should be modelled for them.

If students were to influence the driving behavior of the parents, both would benefit.

"Reverse" parent education may also be useful. If students were to influence the driving behavior of the parents, both would benefit. Parents/guardians will also provide post-licensing supervision, and there may be useful instructional and other influence interventions to be directed at improving their performance in this role as well.

Pre-training

Since there is a lag between learning a value and behaving according to it (Hoffman, 1979), education in some of the values areas and in the critical thinking necessary to it could begin at age 13 (after most have reached formal operational cognitive stage) (Kohlberg, 1981). Since this tends to be an age of high rebelliousness (Rathus, 1988), peer-trainers or novice drivers could be more effective than adults. This would also provide another strong opportunity for "intervention/agent" experience for the trainers and peer organizers. If interactive DE media become readily available, as consumer products, early teens may be interested and find access to them, adding to the knowledge base they will bring to DE when they reach the appropriate age.

Obstacles

Teaching values overtly in schools was out of favor in the previous decades, but more recent wisdom indicates that students are learning values from school, regardless of intent, as part of the "hidden curriculum" (Staub, 1988; Turiel & Smetana, 1989). This has created a new interest in defining values rather than leaving the default values of unintentional teaching. Thus, teaching values, which has been suggested by previous DE designers, will have a better reception in today's educational systems which are now familiar with "pro-social" and values education.

It seems reasonable to be concerned that commercial schools may have difficulty marketing motivational/responsibility content in a highly cost-competitive, unregulated environment, where quick and easy mobility is the key to sales. The qualities of safety motivation and responsibility will likely never be directly involved in deciding whether a driver passes the licensing test. To the extent that the criterion of passing a simple skill test drives the market, commercial schools may face problems selling the highest quality programs. They may need help from insurance and other community resources to make it clear to parents/guardians that the motivational content is worth the time and cost. One major school operator does not share our concern with this perceived problem, suggesting that at least some of the commercial school industry has sufficient confidence in its ability to market safety.

Moral reasoning will be at varying levels in the target age group with most at the conventional level, that is, decisions based on the need for approval and to maintain social order. Remediation and individualized programs may be necessary for those in the preconventional stage (decisions based on expectations of punishment or reward (Kohlberg, 1981; Kohlberg & Candel, 1989).

Pre/post-screening

As research continues to identify traits that may be linked to higher risk behavior, screening should be done in order to determine need for pre-requisite or remedial training. This could also be used for advanced entry for high achievers.

Extending and Maintaining Behavior

Educational strategies for extending and maintaining responsible driving include teaching students the principles of monitoring and modifying their own behavior, and by building into the course appropriate schedules and types of reinforcement to model these methods. For example, since rewards for signalling lane changes are rare, the student must be taught to find a source of internal reward, perhaps self-talk, that can be used to maintain the behavior. Relapse prevention models give us techniques such as identifying high risk contexts, problem-solving for these situations, practising responses, and coping strategies for slip-ups (Sulzer-Azaroff, 1994, 1991). The practice phases will again require life-skills coaches to assist students in mastering tecniques for dealing with risks.

In a broader perspective, "challenge statistics" could be kept for the cohort to compare themselves to another cohort, group, or community. Reward/recognition systems could be set up (by and for the cohort) for months, then years of safe driving. This could be linked to or replaced with group incentives offered by insurers.

4.6 PLANNING AND EVALUATION

Time Requirements vs. Operating and Capital Costs

Driver education was traditionally structured according to a fixed time frame of a certain number of hours for each phase – typically 30 for classroom and six for on-road driving, with perhaps additional time for on-road observing, and perhaps simulator and/or range driving. Some variation around these basics was permitted in competency based programs, where more or fewer hours could be used to bring students up to a performance standard. In at least one state, this flexibility led to shorter average times per student, presumably because the competency standards were not sufficiently challenging.

The inadequacy of the time spent in novice drivers' learning is widely recognized. The SPC application in the DeKalb experiment used about double the usual hours and showed marked improvement in ability. More time may be needed, but, as DeKalb showed, even a substantial increase is no guarantee of success on the safety bottom line.

Expanding instructor hours, and the attendant costs, is a difficult problem. It is seriously intertwined with the fundamental economic and political problems facing driver education. If we compare learning to drive with learning high-performance psychomotor skills, then a major increase in hours would be called for, well beyond what is likely to be seen as reasonable by markets and regulators. Graduated licensing will stretch out the learning process, but by itself it can only encourage more practice in simpler environments, and practice alone may not greatly increase skill levels (*e.g.* Schneider, 1985).

Where instructional hours mean teacher time, each hour is costly, especially in-car. It is very difficult to increase the hours of instruction because of financial and human resource limitations. In commercial operations, where markets are very cost-sensitive and product quality differentiation is difficult, adding substantial operating costs would be especially hard to absorb, unless they were imposed on all competitors through regulation. Even then, unless formal training were mandatory, many fewer people would take training and the market would shrink, defeating the purpose of improving the

Graduated licensing will stretch out the learning process, but by itself it can only encourage more practice in simpler environments…

training. If this more expensive training were made mandatory, it could be seen as discriminatory against those of limited means.

To improve DE quality and impact, better use of instructor time is essential. Automation and greater use of parent education, peer teaching, and group work can help. However, investment for equipment and upgraded teacher training are probably essential to make optimal use of new instructional tools. Many small commercial operators would be left out of technology advances because of the up-front costs involved. In some jurisdictions there is already a two-tiered commercial industry, with larger schools providing two-phase training to some standard, perhaps to qualify graduates for an insurance discount. Small operators may offer only in-car lessons to prepare for the licensing test. Increasing operating unit costs in the upper tier would inevitably force business into the lower tier. The upper tier's ability to absorb capital costs is unclear, but it would probably depend on market expansion to recover the costs without increasing unit costs.

The number of hours to be required in a new DE is very much tied to the economic bottom line. Government regulation of the market, through mandatory training, graduated licensing, tougher license tests, subsidy, or direct regulation of DE are the principal levers. However, insurers continue to support the DE market through premium discounts. These government and insurance efforts are commendable in intent. However, regulatory interventions and subsidies are likely to be inefficient in securing the changes required, both in quality and quantity of DE, unless the interventions can be lined up to provide a positive incentive for the market to seek real quality.

The principal market incentives to seek high quality in ability training could be stringent GPL systems and progressively tougher ability tests, tough enough to make it be seen as unlikely to pass without training. Given the criticality of motivation and responsibility, perhaps most important is a market incentive for students and their parents/guardians to commit to crash-free driving and to seek training which can be shown to encourage it. These incentives could be applied by insurers (Malfetti, 1993).

If one backs up from the desired outcomes into the question of training hours, the obvious conclusion is that the hours invested should be whatever it takes to achieve the performance objectives. For planning purposes, estimates of time needed, and adjustments to it, can be made on the basis of formative evaluation of the instructional media units.

Any increase from the current number of teacher-involved hours is almost impossible to contemplate without drastic changes in the DE industry. It seems sensible to spend what development resources we have in finding creative ways around limitations on teacher resources, rather than spending a few additional dollars on minimal increases in those resources. By injecting information, in the form of training technology and technique, we can produce a larger impact for each teacher hour and operating dollar spent. We can make DE more *knowledge-intensive* and less *labor intensive*.

As discussed in Section 7, graduated licensing can pave the way by providing an expanded duration over which DE can occur, typically two years. With proper structuring, we can uncouple student hours, which are essentially freely given, from teacher hours, which are costly. Teacher hours can stay the same (or decrease or increase slightly as resources dictate) while student hours increase to whatever it takes to meet their individual needs. From the one-shot 30 and 6 format, DE should evolve toward ongoing involvement, say over the whole two-year period of license graduation, with variable individual times being spent to master the required instructional units.

Methods for specific performance objectives

For the design of instructional units, it is necessary to select from among a broad range of methods. Certain methods are more appropriate for some objectives. In order to provide guidance for curriculum developers, recommended approaches are identified to address each performance objective. These recommendations are listed in Appendix I in the format of the objectives outline.

Formative Evaluation

Evaluation is key to successful safety education. The 1986 OECD report on safety education identified three evaluation levels. Two levels were "formative" type evaluations:

1) process evaluation – how the training is used and received, and

2) product evaluation – impacts on skills, knowledge, attitudes, or behavior.

The third evaluation level was "summative" or outcome evaluations, with two types of measures: a) benefit/cost and b) how it fits with the education system at large. Although they must be planned for as goals, assessing benefit/cost outcomes is difficult for the curriculum developer. The safety benefits are not easy to measure. An ultimate, bottom line evaluation of safety impacts probably requires a large scale experiment, such as DeKalb, and some sort of government participation.

Process and product measures are critical from the outset, and they should be part of curriculum development. As suggested above, interactive media can often serve as intermediate measures of mastery, obviating the need for separate tests. Drivers need to balance perceived hazards and perceived abilities to cope with them, and they need better feedback in order to do this.

4.7 CURRICULUM INTEGRATION

Many of DE's instructional objectives have close parallels in other fields of education. Curriculum integration is currently receiving much attention in education generally, as it has on and off for at least the past fifty years. Possibilities do exist for the incorporation of DE concepts into an integrated curriculum and these should be given serious consideration during the development and implementation phases of a new DE curriculum.

The term "curriculum integration" is defined as "the ability to apply existing skills and knowledge in new ways in order to meet needs and solve problems as they arise.…An integrated curriculum is one that is designed to develop this ability in students by helping them to see the links between different subject areas and understand that what they learn is meaningful in the context of the world outside the school" (Ontario Ministry of Education, 1990, p.1). Four forms of integration are usually identified:

> ***Possibilities do exist for the incorporation of driver education concepts into an integrated curriculum…***

- Content – attempts to make connections among different subjects or disciplines
- Skills or processes – attempts to integrate "generic" skills into their contexts
- School and self – attempts to link between the classroom and students' outside world, including their concerns, needs, and goals
- Holistic – refers to all other school-related experiences, such as formal and informal practices, routines, methods, and rules.

Curriculum integration proponents believe that the traditional subject-based curriculum not only is too rigid in its compartmentalization of each subject, but also fails to keep students interested in school. Driver education, however, may have an advantage over most subject areas, because students have a clearly identifiable goal in becoming licensed to drive.

In terms of content or subject integration, direct connections can be made with science, mathematics, and health and safety curricula. For example, velocity, braking distances, eye movements, reaction time, friction, and many other concepts related to the science of driving could be readily integrated with traditional science curriculum components. High-relevance issues of driving regulation and economics could contribute to law and social science learning.

Similarly, the broadly applicable psychological aspects of driving include attitudes towards driving, alcohol use, other drivers, car ownership, risk taking, power and control, maturation, frustration-aggression, self-esteem, social conscience, prejudice, behavioral influences, human engineering, self-management/autonomy, and environmental responsibility. These could be discussed in health and safety or possibly language arts instruction. Issues related to driving responsibly can, and probably must, be linked to wider issues in values, ethics, pro-social, leadership and community service education. Learning in one area is likely to have effects on another (*e.g.*, Batchelder and Root, 1994).

In Europe, driver education tends to be integrated into a broader health and safety awareness curriculum. Writing about French language instruction, one teacher maintains that "such topics as automobile nomenclature, driving regulations, and learning how to drive, when taught in a foreign language, can be used to present vocabulary, grammar, and comparative cultures" (Berwald, 1980 p.205).

An useful example of the integration of DE with a science curriculum comes from Australia. The Road Traffic Authority (RTA) produces curricular material called *Science and the Road.*

In Europe, driver education tends to be integrated into a broader health and safety awareness curriculum.

The Driver *unit is concerned with the relationship between human biology and driving performance; topics in the unit include reaction time, the nervous system, the brain, the effects of age, alcohol and other drugs, vision and hearing. The* Vehicle *unit which explores the physics of roads and vehicles, contains sections dealing with forces, inertia, friction, speed and stopping distances, curves and energy. The units are intended for use at around Grade Ten level, and are normally taught as part of a science course. (Gardner, 1989 p.74).*

In schools where the curriculum was integrated, it was found that the material has a highly significant result on students' knowledge in comparison to students who did not study the curriculum. Furthermore, the material has widespread support from teachers who felt it had real-life applicability and was highly motivating for students. However, there were also problems with the implementation. Although curriculum kits had been sold to 60% of schools, only about 20% were actually using it, and of course, not all students in the school would be introduced to the integrated material. Reasons for non-adoption included low level of staff interest, non-compatibility with the school's science curriculum, and the belief that road safety education was not the responsibility of science staff. There was also some evidence that the quality of teaching of the integrated curriculum was in some cases less than optimal. It was discovered that teachers with strong biology or physics backgrounds had a clear advantage in teaching the materials and it was recommended that more in-service courses in these areas would benefit the integration of the driver curriculum.

The notion of broad curriculum integration challenges teachers' notions of classroom orderliness and self-autonomy. Educators are hired as content specialists, and identified as such in their work. Those teaching in a high-status area fear alignment with a lower-status specialization. They also express concern that teachers will be required to teach outside their area of expertise, resulting in a less effective learning environment. This reflects the common argument that curriculum integration leads to vagueness or lack of precision.

Integrating driver education will undoubtedly require addressing the concerns of integration opponents, if not on a general policy basis then at least on an individual teacher basis. DE has a strong appeal for some level of integration, and approaches to implementation should be explored further. It is our belief that a powerful argument can be made for examining the potential for integration at all school levels in order to inculcate behavioral norms and values related to responsible driving in students as early in their school lives as possible.

Another consideration for driver education curricula is federal, state, and provincial statutory requirements that impose integration of other subject matter into driver education. For example, the federal Goals 2000 strategy in the United States requires integration of many global concepts into all aspects of education in the schools, including driver education.

SECTION 4 SUMMARY

- Greater efficiency in mastery of abilities is critical for safety impacts.
- Different people have different preferred learning styles and rates.
- Trends are toward participatory classes and computer-based multimedia support.
- Classroom lectures should be replaced by seminars and group work.
- Textbooks and lectures should be replaced by individual multimedia interaction.
- Realistic full-task simulation is not likely to be widely available for many years.
- Part-task components can be mastered by simulation to free up mental resources.
- Instructional units and materials need to be structured in free-standing modules.
- Units should be given process and product evaluations, and continuous improvement.
- Teachers will need life-skills and social-skills coaching abilities.
- Peer trainers, coaches, team and discussion leaders, and proctors should be heavily used.
- Parent/guardian involvement will need to be increased and support for it developed.
- Motivation and responsibility improvements require commitment to social and moral values.
- More learning time cannot necessarily involve more teacher time.
- Possibilities exist for incorporation of DE concepts into an integrated curriculum.
- Integration may positively affect motivation to learn as well as skills and abilities.
- Direct connections can be made with science, mathematics, and health and safety curricula.
- Issues of driving regulation and economics can contribute to law and social science learning.
- There is often resistance to integration across subject boundaries.

5. SUPPORTING NON-INSTRUCTIONAL INFLUENCES

The best of driver education can clearly improve skills and knowledge. To improve how drivers actually choose to perform, as opposed to what they are able to do, will require behavioral influences beyond the narrow confines of driver education as it has been traditionally conceived. There are important and numerous opportunities for coordination with other influence resources, ranging from community and workplace health promotion programs and insurance incentives to selective enforcement programs and teen peer organizations.

5.1 COORDINATING COMMUNITY INFLUENCES

Coordinated non-instructional influences may well be essential to achieve a sustained safety improvement in novice drivers. It may, of course, not be realistic or necessary to have every possible influence operating in a community to have a positive effect. However, DE should make use of the best available local resources. Resources and expertise to support coordinated influence programs could be provided through a variety of local, state and national organizations such as:

- Public health authorities
- Auto clubs
- Insurers
- Trade associations
- Healthy Communities programs
- Workplace health and safety organizations
- Association of Occupational Nurses
- Association for Health Promotion Aides
- Youth organizations
- Wellness Council of America

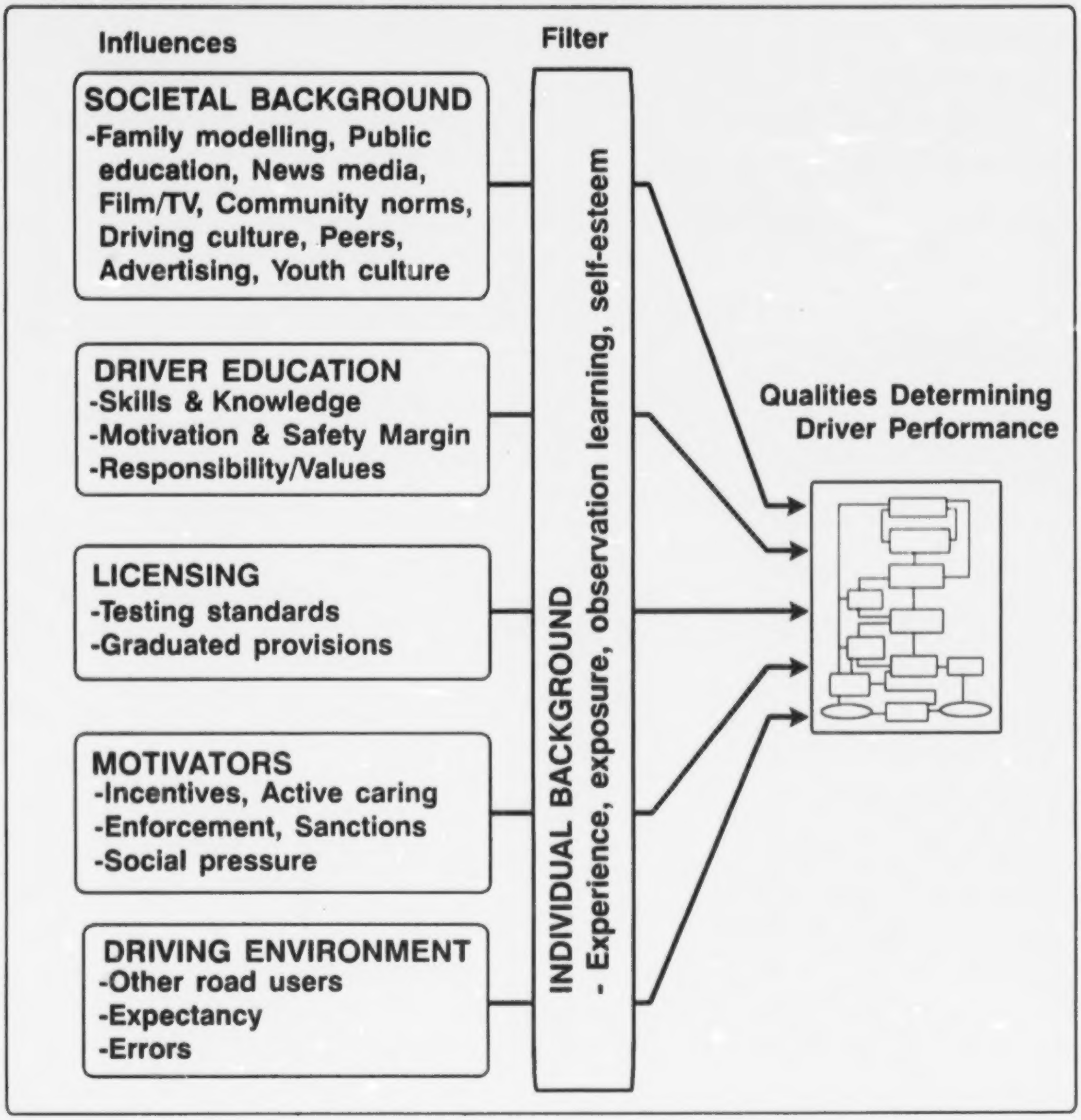
A coordinated community-based approach, often found in health promotion programs, is worth consideration in seeking out influence resources for reinforcing driver education. Quite some time ago, Green pointed out the need from a public health perspective, writing:

> *The question is not whether the schools should educate, but rather how to supplement the classroom experiences with the appropriate services and safeguards in the community to reinforce and support the positive effects of the education and offset some of the inevitable negative effects. For driver education, the community must coordinate the timing and enforcement of education services and legal restrictions...the community has no choice but to educate its young citizens in matters critical to their survival and development as responsible and competent participants in society (1980 p.626).*

A development and implementation model which includes guidelines outlining how to access and coordinate local resources should be developed as part of a new curriculum. The greater challenge with a coordinated influence approach will be finding management resources to take responsibility for it. Figure 5.1 suggests the major influence streams that serve as a background for a coordinated community approach. Driver education coordinators and managers should play an important, if not always central, role in the organization of community resources. In the best of all possible worlds, of course, the young drivers themselves would take a leadership role along with (or perhaps even better, in advance of) adult community health and services leaders. Selective traffic enforcement programs (STEPs) on violations associated with novice drivers' errors, along with community promotional activities and heavy publicity, can introduce credible disincentives to willful errors (Engel, 1980; Lonero *et al.*, 1995). A well-managed STEP program can open up another "educational channel" for drivers, through the local news media, and this channel can be kept open with appropriate education and support for media personnel (Wilde and Ackersviller, 1981).

It is noteworthy that NHTSA has sponsored a number of efforts to focus attention on younger drivers. A *Forum on Youth Traffic Safety Initiatives* was held in 1989 which published recommendations organized according to the Agency's "Youth Traffic

Figure 5-1 Community Influences on Novice Drivers


Influences
Filter
SOCIETAL BACKGROUND
-Family modelling, Public education, News media, Film/TV, Community norms, Driving culture, Peers, Advertising, Youth culture
DRIVER EDUCATION
-Skills & Knowledge
-Motivation & Safety Margin
-Responsibility/Values
LICENSING
-Testing standards
-Graduated provisions
MOTIVATORS
-Incentives, Active caring
-Enforcement, Sanctions
-Social pressure
DRIVING ENVIRONMENT
-Other road users
-Expectancy
-Errors
INDIVIDUAL BACKGROUND
- Experience, exposure, observation learning, self-esteem
Qualities Determining Driver Performance

Safety Model." This model outlines nine program areas for reducing traffic fatalities in a community: school-based, enforcement, extracurricular, licensing, community-based, adjudication, work-based, supervision, and legislation.

While coordinated influences will have to be shaped to fit communities, at a smaller scale than the state or province, it would be worth considering local based customization of the DE curriculum and methods to complement whatever mix of non-instructional influences can be mustered locally. A part of DE may have to be that it trains community resources to help train and otherwise influence novice drivers in its community.

The potential linkages with community and workplace health promotion programs are best understood by viewing driver safety, of which driver education is a principal component, as a health and safety concern. In this context, efforts should be made to promote driver education and support the motivation, evaluation, decision, and responsibility objectives (identified in Section 3) within the broader school and social community of each novice driver.

For example, in discussion with experts in the alcohol and drug abuse field, the following options have been identified:

- Look for linkages in the area of violence prevention and policing of "aggressive drivers."
- Use connections between driving safety and substance abuse; similar concepts are used, e.g., health hazards, risk perception, negative consequences, positive rewards for appropriate behavior, payoffs, parental involvement, self mastery, refusal skills, peer group influences.
- A recommended peer influence approach involves assisting novice drivers in the identification of strategies that make them less susceptible to "negative" pressures. Provide norms/values that are both acceptable to the individual and comfortable to use in interaction with peers.
- Provide simple, easily remembered and used behavioral "tips" that directly assist the novice driver to select the right response when faced with making difficult decisions. These will help build self-efficacy towards adopting safe behaviors.
- Identify and provide opportunities to practice options, different ways to behave, and choices whose consequences or outcomes can be assessed ahead of decisionmaking.
- Involve parents and families as much as possible; provide tips for parents such as how important it is to be good role models; and send home materials for other members of the family.
- Use the workplace as a venue for influence through existing employee services such as occupational health services and providers, lunch hour series, parenting, stress management and other employee health promotion seminars, alcohol awareness, and other annual health events. Many of these are directed to the employees and their families, and could address novice drivers in the families. Caution: providing information "handout" materials is likely to be well received, but integration of programs is more difficult.

As happened in the anti-DWI movement, there is need for national/state/provincial focus that reinforces local efforts. While governmental support would be an obvious possibility, auto clubs and safety councils could also take a leadership role. The auto clubs' widespread local presence, broadly based membership, and interests in both the driver education and insurance industries might be in an especially strong position from which to help coordinate beneficial safety influences for novice drivers, their parents/guardians, and their communities.

Geller's *Intervention Impact Model* classifies a comprehensive range interventions into 24 types (Geller *et al.*, 1990; Geller and Ludwig, 1990). These are analyzed from a behavior analyst point of view, which looks especially for the factors motivating behavior. This model can provide for community programs trying to influence drivers' motivations.

Geller and Ludwig's 24 Behavioral Interventions

1. Lecture: Unidirectional oral communication by an agent concerning the rationale for specific behavior change.
2. Demonstration: Modelling the desired behavior for target subject(s).
3. Policy: A written document communicating the standards, norms, or rules for desired behavior in a given context.
4. Commitment: A written or oral pledge to exhibit a desired behavior.
5. Discussion/Consensus: Bidirectional oral communication between agents of an intervention program and target subjects.
6. Intervention Agent: The subject(s) participate in promoting the desired behavior to other individuals.

7. Written Activator: A written communication that attempts to prompt desired behavior.

8. Oral Activator: An oral communication that attempts to prompt desired behavior.

9. Assigned Individual Goal: An intervention agent mandates the level of behavior change the subject should accomplish by a certain time.

10. Individual Goal: The subject decides the level of desired behavior (i.e., the goal) that should be accomplished by a specific time.

11. Individual Competition: An intervention promotes competition between individuals to accomplish the desired behavior first (or best).

12. Individual Incentive: An announcement to an individual in written or oral form of the availability of a response-contingent reward.

13. Individual Disincentive: An announcement to an individual specifying the possibility of receiving a penalty.

14. Individual Feedback: Presentation of either oral or written information concerning an individual's desired or undesired behavior.

15. Individual Reward: Presentation of a pleasant item to an individual, or the withdrawal of an unpleasant item from an individual for emitting a desired behavior.

16. Individual Penalty: Presentation of an unpleasant item to an individual, or the withdrawal of a pleasant item from an individual following undesired behavior.

17. Assigned Group Goal: An intervention agent mandates the level of desired behavior a group should accomplish by a certain time.

18. Group Goal: Group members decide for themselves a level of group behavior they should accomplish by a certain time.

19. Group Competition: An intervention promotes competition between specific groups to accomplish the desired behavior first (or best).

20. Group Incentive: An announcement specifying the availability of a group reward contingent upon the occurrence of desired group behavior.

21. Group Disincentive: An announcement specifying the possibility of receiving a group penalty contingent upon the occurrence of undesired group behavior.

22. Group Feedback: Presentation of either oral or written information concerning a group's desired or undesired behavior.

23. Group Reward: Presentation of a pleasant item to a group, or the withdrawal of an unpleasant item from a group or team following desired group behavior.

24. Group Penalty: Presentation of an unpleasant item to a group, or the withdrawal of a pleasant item from a group or team following undesired group behavior. (p.42)

The likely effects of the types of influences available can be predicted with Geller's Model. In the model, influence interventions with strong participatory involvement, social support, and information are rated as most effective. Adding extrinsic controls, such as incentives, strengthens the effects further in the short term, particularly where there is peer group involvement, such as in a group incentive program. Geller prefers association of rewards with behaviors or processes, rather than ultimate outcomes, in effect rewarding effort rather than bottom-line results. Geller's concern is that results are not entirely within the individual's control and that linking rewards to them could lead to learned hopelessness.

In contrast to the behavior analyst's view on behavioral influence is the utility-theory view, as reflected by Wilde (*e.g.*, 1994a), who would say that rewarding a specific behavior will lead to improvements in that behavior but deterioration in other behaviors, unless the safety outcome is rewarded. The comprehensive view sought here would suggest rewarding both behaviors and outcomes, for maximum effect with minimum side effects.

Geller and Ludwig (1991) also devised a rating system for behavioral influences according to two sets of criteria: 1) immediate effects, and 2) long-term effects. Among Geller and Ludwig's list of 24, number 5 Discussion/Consensus and number 6 Intervention Agent are high in long-term rating, having strong involvement, social support, and information components. The impact of discussion/consensus can be achieved in group work and seminar units. Intervention/agent interventions require active involvement and commitment, as would occur in students working for a youth safety organization, peer teaching, or even coaching their parents' driving.

Influence interventions strong in involvement, social support, and high information, as well as providing extrinsic control, are the strongest in short-term ratings, and equal to the two above in long-term rating. The would-be influencer of individual driver's behavior can find much food for thought in the theoretical and empirical foundations of this model, and in its effectiveness predictions for specific behavioral interventions, educational and otherwise.

While Geller and Ludwig's model is quite comprehensive, the mechanisms of action are necessarily dealt with in a rather compressed fashion. For a fuller understanding and appreciation of behavior change, the curriculum developer should also look to the other theories, where certain potential behavior change mechanisms, though subsumed by the Intervention Impact Model, are spelled out in expanded detail and from viewpoints other than that of the behavior analyst. Lonero *et al.* (1995) provided an overview of behavior change methods specifically related to road users' behavior.

James Malfetti (1993) has recently proposed a specific insurance incentive/disincentives for individual new drivers. He also reported a plan by an auto club to offer a somewhat different insurance incentive. This plan is more consistent with earlier incentive design suggestions by Wilde and Murdock (1982), Lonero and Wilde (1992), and Lonero *et al.*(1995), but it also is aimed only at individuals. Combined group and individual incentives give students some stake in what others do, and have been seen to be somewhat more effective in industrial settings. Wilde designed the so-called Saskatchewan Plan, to provide insurance rebate incentives to young Saskatchewan drivers, based on both individual and group performance in a local area. The plan was never implemented.

Combined group and individual incentives give students some stake in what others do, and have been seen to be somewhat more effective in industrial settings.

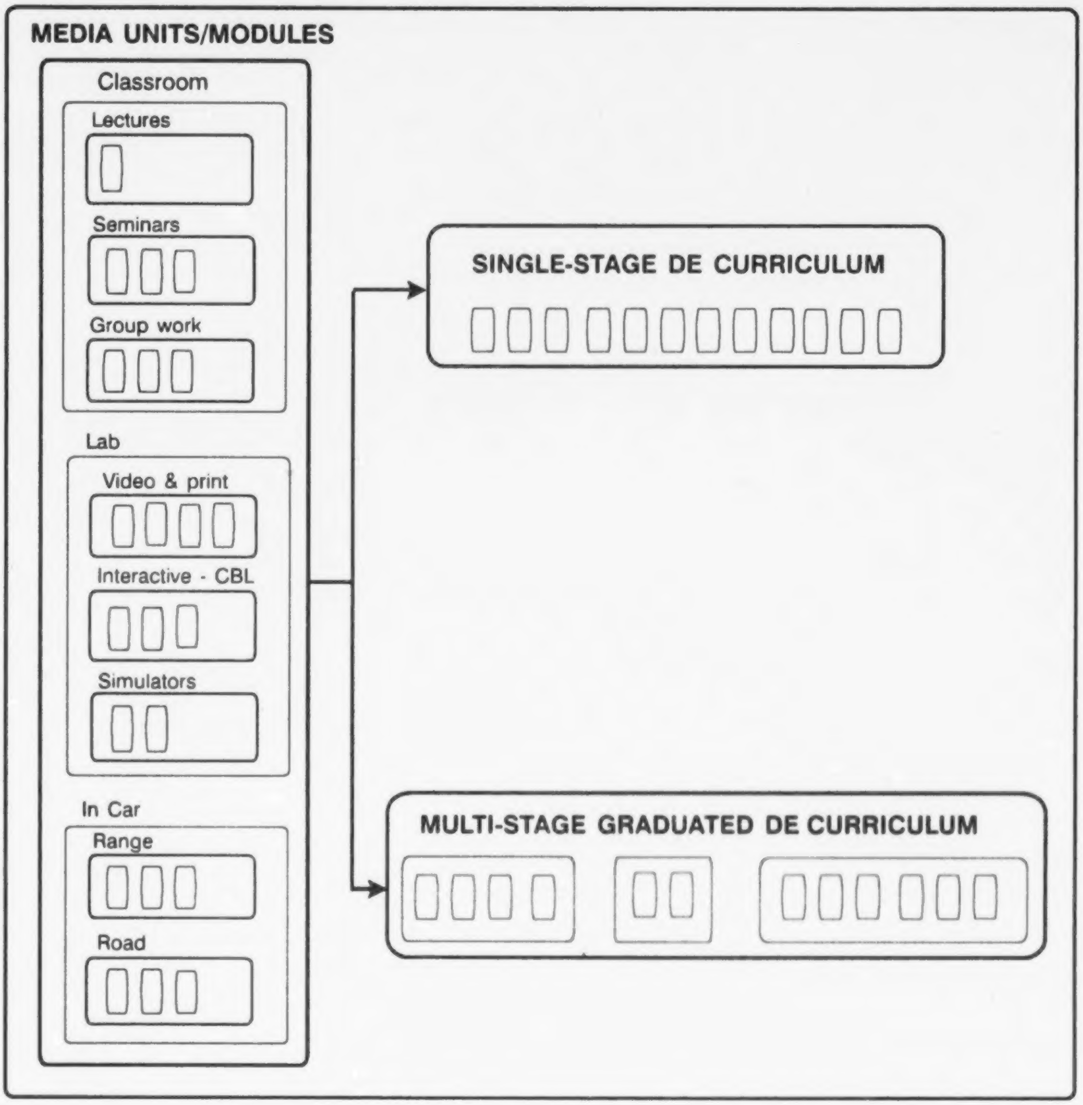
The opportunities for group participation, involvement, and information intensity of a renewed driver education, along with other community influences and, particularly, well-designed incentives, promises a powerful behavioral influence synergy. The motivation to be safe is individual, social, and cultural. This suggests that community education programs should be a part of a comprehensive behavior-change strategy for novice drivers, to provide immediate support for positive behavior change and to help establish more wholesome cultural norms.

5.2 LINKING DRIVER EDUCATION WITH GRADUATED LICENSING

Graduated or provisional licensing systems (GPLs) may add considerable weight to the influences on novice drivers. The intent of these licensing systems is a more gradual introduction of inexperienced drivers into the traffic system, limiting their early exposure to the riskiest situations and providing more stringent standards for impaired driving and other risky behaviors. Waller (1993 p.4) summarized the "easing in" effects of graduated systems and the sanction threat of provisional systems as follows:

> *Such a graduated system of supervised practice would address the problems of inexperience. However, to the extent that the young driver's problems are attributable to a greater deliberate tendency to take risks ... greater threat may be reasonably imposed. While threat cannot improve inexperience, it may be expected to exert an influence on deliberate undertaking of high risk behavior, such as speeding or driving after drinking.*

Figure 5-2 Building Modular DE Curricula


MEDIA UNITS/MODULES
Classroom
Lectures
Seminars
Group work
Lab
Video & print
Interactive - CBL
Simulators
In Car
Range
Road
SINGLE-STAGE DE CURRICULUM
MULTI-STAGE GRADUATED DE CURRICULUM

A number of mechanisms could mediate the safety effects of effective GPL systems. A reduction in overall exposure to risk and to high-risk situations in the first years would automatically reduce losses on a per-driver basis. Even where license restrictions are violated, the threat of more severe than usual sanctions if caught in a violation or crash would likely induce more careful driving. This greater care could generalize to other situations and times, as seems to happen with drivers who continue to drive when their licenses have been suspended (Hurst, 1980). The GPLs also provide structure and motivation for greater parental involvement in the early driving years (Waller, 1993).

Legislation, as society's "conscience," and the publicity surrounding introduction of controversial paternalistic regulation, have educational effects and may have considerable effect, at least temporarily, on behavior (Bonnie, 1985; Friedland *et al., 1990)*. This "declarative" effect of legislation may be transient, or it may add weight to a wider set of influences that lead to broad cultural change, as seems to have taken place around the acceptability of DWI, for example. Many regulatory initiatives have an initial impact, which then declines for various reasons, including that the threat posed by them was initially overestimated (Lonero *et al.*, 1995). The ultimate effects, if any, depend on authorities "learning" to operate the programs better, usually by coordinating a number of separate influences on the same issue. Seat belt legislation is a classic example.

It is hard to avoid fascination with a potentially effective new influence tool like graduated licensing, but it is how skilfully the tool is used **in concert with other influences** that will probably determine its ultimate effectiveness. So much faith is being placed in graduated licensing that the disappointment potential seems quite high. The best way to avoid this disappointment is to support GPL effects with other coordinated influences, such as more effective driver education, parent involvement, and community influences.

Driver Education in a GPL World – What? When? and by Whom?

In those jurisdictions that choose to adopt GPL, the systems may have, at least, substantial transient impacts on the driver education market. A major wave in the market may occur as young people rush to get their licenses in advance of the graduated system's implementation, leaving a trough in demand after the system becomes operative.

Over the longer term, graduated licensing may make possible and logical a major renewal of interest in and reshaping of DE. Extending the time over which novice drivers learn is the goal of GPLs, and it has been seen as desirable among driver educators and researchers as well (NHTSA, 1994). A sensible experimental direction for DE would be to divide a program into two (or more) stages, to correspond with graduated driving privileges. Since different jurisdictions will require different staging, the curriculum will have to be flexible and modular, as suggested in Figure 5.2.

While this is a very attractive proposition, it raises serious questions of when to teach what. The immediate first answer to the question of content for a second stage DE is that it would resemble current "advanced" driver training courses. These consist of two basic types: 1) perception-oriented defensive-driving-type courses; and 2) hands-on, skid school-type courses. There is little research evidence to suggest strong positive effects of either of these approaches as they have been applied in the past, but they have been evolving and, like novice DE, their current effects are less than clear.

Ontario is currently developing an "exit test" from the second stage of their graduated system.

An alternative to using adaptations of existing advanced driving curricula would be an approach that addresses the same range of content as the first stage course, but more intensively and in a more demanding set of environments. The latter approach seems to be conceptually closer to "advanced" license testing approaches that will likely be adopted in graduated programs. Ontario is currently developing an "exit test" from the second stage of their graduated system. While the details of the approach in the Ontario test are not available at this writing, it is apparently based on similar test technology as the California single stage advanced test currently being pilot tested. California's test, in effect, looks at the same skills more precisely and reliably. A second-stage graduated test likely will be tougher to pass, not because it taps different skills, but because it takes a longer, closer look at the same skills in a wider and more demanding set of situations.

There are likely many benefits to be gained from a longer, tougher licensing test, not least of which is that it may encourage people to take more time and better training to prepare for it. Nevertheless, there is no logical reason why a second-stage test should necessarily drive the shape of second-stage driver education, rather than the other way around. The practical reason would be that the test is likely to be in place earlier, and people will want the training to help them pass the test. It is unlikely that a jurisdiction will have second stage training in place before it implements graduated licensing, as there would be little market, unless some other incentive were introduced for it. Neither testing nor driver training has a really strong empirical connection to risk. The new tests would typically be validated by showing that experienced drivers do better than new drivers on the test, which gives a moderate empirical connection to future crash risk. There is, of course, no guarantee that new drivers who do well on the same test will crash any less, if skill is not the reason for the crashing. In the DeKalb study, the SPC graduates were more skilled, but crashed less for only a short time after licensing. The logical problem is similar for both testing and training: both can deal successfully with skill, but lack of skill is probably not the only, or even necessarily the most important, novice driver problem. Even a perfect testing system will only see what drivers can do when they are on their very best behavior, not what they will choose to do later.

Neither testing nor driver training has a really strong empirical connection to risk.

Multi-stage DE could be "driven" either by second stage GPL testing, by our current conceptions of advanced training, or by some new model. It is clear that we lack sufficient information now to say confidently what the most effective content and structure for multi-phase DE curriculum should be for all time. These should, of course, be empirical questions, but it will be difficult to answer clearly with data unless some fairly sophisticated research is carried out.

In terms of structure, some guiding general principles for a just-in-time delivery approach to multi-stage DE can be achieved if instructional units are provided or made available at a time or order so that:

- Entry-stage training diagnoses the wide variation of entry knowledge and skills for branching to remediation or advanced standing;
- They can be practiced or used when they are learned. For instance, avoid giving night-driving or freeway training if the student faces a year of no-night-driving or freeway restrictions;
- Later stage units occur when there is readiness to learn them, without interference or excess attentional demand from basic tasks requiring controlled processing;
- Cognitive/evaluative and motor skill integration instructional units occur when more basic performance skills are thoroughly mastered and automatic;
- Later-stage units follow sufficient supervised practice and experience that they meet the felt needs of the student, providing solutions to problems that they can relate to concretely;
- Later-stage units provide a higher-level integration consistent with the greater degree of students' experience – letting them practice what they have learned in principle and discover the principles of what they have learned in practice;
- The instructional design recognizes that later stages are operating in direct competition with the often perverse informal observational learning and error-forgiving feedback of the natural driving environment; and

- All stages are seen as essential to getting through the graduated system efficiently.

Structural specifics will have to be customized to correspond with the wide variety of graduated systems that will likely develop in different jurisdictions. These custom designs can be made in a fairly straightforward manner and with reasonable confidence from these principles and existing training/pedagogical methodology in DE and other training fields. Content questions, however, are going to be harder to answer.

Can better drivers drive worse?

Highly problematical in the near term would be advanced training of the car-handling, skid-school type. Norway established mandatory attendance at brief training courses in driving theory, night driving, and slippery road driving to qualify for exit from its provisional license, which was introduced in 1979. Although the training requirement is being dropped in 1995 (Fridulv Sagberg, personal communication), this experiment provides some direction as to what might be placed into a second-stage DE curriculum. In Norway the slippery road car handling training made male drivers more likely to crash afterward (Glad, 1988), and there are other similar findings in Oregon (Jones, 1992) and Germany (Siegrist and Ramsier, 1992).

It is probably not appropriate to categorize dry-road types of evasion training, such as off-road recovery and head-on or rear-end crash avoidance, together with slippery surface training, from which they seem to differ qualitatively. These evasive maneuvers are currently used in some novice DE courses. The specific dry road evasive maneuvers are more like normal driving, less like stunt or race driving, and probably less fun to practice on one's own later. They may, of course, lead to overconfidence in one's ability to evade unexpected hazards in real life.

One would need to approach implementation of advanced car handling training very carefully as part of any driver education program, perhaps especially a second-stage program where graduates are about to receive their first full driving privileges. They may also be nearing a peak in their confidence in their driving ability, having successfully mastered driving under deliberately sheltered conditions.

The exact mechanism by which advanced car handling may cause more crashes is not known, but overconfidence may be part of the problem. The German finding, that graduates who reported that the course had helped them the most had the worst subsequent records, perhaps supports the overconfidence hypothesis. There is also a strong possibility that some drivers drive harder and more aggressively, pushing closer to the edge of control when they know more precisely where the edge is. It may be possible to design an advanced skid-type course that produces beneficial learning without engendering overconfidence. Lonero *et al.* (1995) reported anecdotal evidence that suggests this result from a brief handling course presented to Canadian college students.

The exact mechanism by which advanced car handling may cause more crashes is not known, but overconfidence may be part of the problem.

The objective of advanced car handling training should be to use the concrete reality of carefully organized in-car experience to permit discovery and reinforcement of certain motivational, perceptual detection, and responsibility objectives:

- better appreciate the normal proximity of the limits of control;
- recognize the driver's own limits, perhaps compared to experts;
- develop a "feel" for surface texture and friction differences;
- detect incipient skids;

- generate an aversive gut reaction to incipient loss of rolling traction; and
- strengthen commitment to wide safety margins.

Perhaps this would best be achieved without actually improving the skills for handling "over-the-edge" situations or increasing the students' confidence in these advanced motor skills. Even this modest training experience, however, may increase confidence, in knowing better where the edge of control is. It may also challenge some drivers to try to develop advanced skills on their own (now that we have clearly shown them that they do not have the skills of stunt drivers and other experts), and perhaps they will practice extending the boundaries of the envelope of control on the public roads.

Given the apparent potential for doing harm, the advanced car-handling approach should only be used where there is sufficient motivational influence to ensure that the skills developed are used to increase safety and not for other purposes. The potential for advanced handling skills is strong, but as with most powerful tools, it must be used properly to avoid harm. A substantial research and development effort would be justified to help realize this potential. In the meanwhile, it may be necessary to field a two-stage DE curriculum before we know how to teach car handling to young males without making them worse. For practical purposes in the short to medium term, we need to try out a number of different multi-stage approaches that seem on theoretical and empirical grounds to have a fair chance of doing more good than harm. A large number of optional arrangements are logically possible. Two basic approach options for two-stage programs and a suggestion of more complex multi-stage and continuous-process structures are outlined briefly below.

Option 1: Stage 1 Comprehensive – Stage 2 Perceptual/Cognitive Advanced

A modest consensus could likely be produced for a focused and intensified "graduate level" course in perceptual and cognitive skills for crash avoidance, as a second stage following after some time a comprehensive DE program. The narrowed focus of the Stage 2 training module suggests that it would be smaller than the Stage 1 module, which would presumably more closely resemble a comprehensive single stage course. The Norwegian night driving module was shown to have a positive effect on males' driving safety.

The Stage 2 course would be a cognitively oriented risk evaluation and decision course. It could focus on the Educable Qualities 6, 7, and 10 and some of their subsidiary Topics:

Evaluation
Risk Assessment
Personal Limits
Expectancy
Attribution Bias

Decision
Risk Acceptance
Option Matching
Response Selection
Retry/Abort

Responsibility
Self Monitoring
Transient States
Conflict Avoidance
Crash Avoidance
Role Modeling
Leadership
Environment

This would extend and reinforce strong motivational, risk-acceptance, and group work components, components of the comprehensive Stage 1 course, preferably with diagnostic and in-car components for assessment, branching, and remediation. This approach is likely the gentlest departure from current practice.

Option 2: Stage 1 Minimal Pre-driving – Stage 2 Comprehensive

A second option would reverse the scale of the Stage 1 and 2 modules, starting with a minimal prelicensing entry course, and providing a comprehensive Stage 2 course. This approach is consistent with one suggested by McKnight (1984), who pointed out that rank beginners are less capable of absorbing some needed information and training. As youth is said to be wasted on the young, much of driver education may be wasted on those who cannot yet drive. For the first stage in this approach one would identify a small set of:

- low level objectives to permit basic car handling;
- a parental training package;
- practice exercises for driving with parents; and
- self-instruction, home video, and interactive CBL materials.

Many performance objectives, such as those addressing high speeds, night driving, or risk acceptance, could be left out of the Stage 1 package altogether, because they are not needed within the restrictions imposed, can be provided by the accompanying parent or better left until Stage 2. One might also attempt to plant the seeds of concepts that may lead to discovery learning during Stage 1 driving and that will facilitate later learning at Stage 2.

> ***As youth is said to be wasted on the young, much of driver education may be wasted on those who cannot yet drive.***

Stage 2 training in this option would likely have to be given at the entry to Stage 2 privileges, as there may be critical gaps in skills, knowledge, and motivation for coping with Stage 2 graduated privileges. Diagnostics, remediation, branching, and self-paced progress would be relatively critical at Stage 2 training in this option, as the range of entry level competencies would probably have been affected by the Stage 1 experience.

Option 3: Multi-stage, Just-in-time DE

A third type of option would involve more than two stages. The simplest variation would add another module, for example to produce a sequence:

- Graduated Stage 1 Entry Course
- Graduated Stage 2 Entry Course
- Graduated Stage 2 Exit Course

This would permit still closer matching of training and opportunity to use new knowledge and skills over the duration of the graduated time frame.

A more complex approach, and perhaps a qualitative departure, would see elimination of fixed time frames of the instruction altogether, making it essentially a continuous process over the graduated period. At the limit, this might be seen as less like taking a course and more like joining a sports or other club where skills, self-discipline, commitment, values, personal standards of conduct, and leadership are developed and shared, such as an alpine climbing club or martial arts club. Peer teaching and self-paced, self-directed and computer-based learning could be integral to such an environment, with the in-class teacher serving more as facilitator and coordinator. Students could be made responsible for coordinating their in-car and other learning experiences.

Who could deliver multi-stage DE?

Multi-stage DE seems essential to take full advantage of the safety opportunities presented by graduated licensing, and to protect the long-term effects of these licensing systems. However, the practical problems presented by the multi-stage training are enormous. Even if not much longer in total time than current programs (in itself a tall order) these new programs would represent a major logistical complication. How this might be handled by an infrastructure that has been increasingly unable to deliver the much simpler existing courses is problematical. While it is widely hypothesized that extending the time of learning to drive should be helpful, it is not clear that multi-staging alone would make current DE content sufficiently more effective to meet safety requirements. More likely, a reorientation of content, methods, and coordinated influences would be required as well, complicating and raising the costs of implementation of any effective new program.

An extended, multi-stage or continuous-process DE would seem to be a possible fit in the schools, where, at least, the students are present over an extended period. It may, however, be that many students would graduate from high school before their graduated licensing periods had run their course, limiting their access to training over the whole period. Early school leavers would be left out nearly from the start, and to a greater extent than in the current system, where they might be able to complete a single stage course before leaving. A simple two-stage program, with short, conventional course modules, could be suited to delivery by some existing commercial driving schools. Because of limitations of space and other facilities, it is harder to see them delivering a more complex model, with very much self-paced learning, peer teaching, or group work.

Any moves toward multi-stage training likely require a broad and flexible partnership among government, schools, driving schools, communities, and families, as well as insurance and other businesses, with both top-down and community support leadership. However, similar organizational changes will be needed for more effective driver education, even without the graduated license linkage.

SECTION 5 SUMMARY

- Improving how drivers choose to perform requires behavioral influences beyond driver education as currently conceived.
- Coordinated influences can be developed through various types of organizations in communities.
- DE will have to take a leadership role in developing coordinated influence resources.
- Youth and community groups can provide participation, involvement, and peer influences.
- Individual and group incentives show promise for strong support of safer behavior in novice drivers.
- Graduated or provisional licensing systems (GPLs) may add considerable positive weight to the influences on novice drivers.
- Effective mechanisms of GPLs could include increased supervised practice, tougher second-stage testing, and increased threat of sanctions/disincentives.
- GPLs are likely to need support from other influences to have a lasting effect.
- GPLs influence the DE marketplace.
- GPLs imply parental involvement, multi-stage DE, and tougher multi-stage license testing, and these should be planned in harmony.
- Sequencing of instruction in multi-stage DE needs to be studied further.
- Highly modular, individualized, and self-paced DE curricula can provide the flexibility to accommodate the diverse needs generated by different GPLs.
- Multi-stage DE raises major issues of organization, coordination, and delivery.

6. SUMMARY AND RECOMMENDATIONS

SUMMARY

We can view its current diminished status in North America as an opportunity to reinvent driver education and help realize its safety potential. Demographics (the baby boom echo), economics (recovery from recession), and likely future political trends (outrage over increased casualties) all make this a timely effort.

A more comprehensive and detailed understanding of the particular needs of novice drivers must be brought into DE to reach its safety potential. Skills in processing information and evaluating risks must be addressed by more effective training methods. Improved skills may be necessary, but they are not sufficient – much of novice drivers' risk results from what they choose to do, not from what they are able (or unable) to do.

Stronger motivation for safety compensates for lower skills better than higher skills compensate for poor motivation. Better risk perception skills may help, but enhanced personal motivation and social responsibility are the keys to improved safety for novice drivers.

Individualized, interactive instructional methods for teaching knowledge and skills can free up resources to concentrate on motivation. Better trained teachers and improved classroom methods, involving peer influences, can improve motivation and responsibility.

Parental involvement, both before and after licensing, are critical. Knowledge and values related to various health maintenance and pro-social behaviors can be better integrated between DE and other subjects. Community, cultural, and economic influences can also be brought to bear on novice drivers' motivation. Graduated licensing has great potential if properly coordinated with driver education and other influences.

Driver education will become more pluralistic, dynamic, and diverse as the involvement of private organizations increases, in response to expanding business opportunities in the field. Computer-based interactive technologies will lead early DE development, but issues of overlap, standards, and compatibility will develop as a result of numerous, competitive developers entering the field.

The toughest and most critical challenges for DE will be developing effective and practical means to improve motivation, training and supporting teachers to deliver this education, and mobilizing coordinated influences in families, communities, industry, and governments.

RECOMMENDATIONS

1. Develop software for teaching and testing knowledge and skills in an individual, self-paced, automated way.
2. Develop interactive multi-media units for training and testing driver attention and visual detection as well as risk perception and evaluation.
3. Develop software based on game-theory models to diagnose, clarify, and reinforce modification of new drivers' risk-taking styles and to demonstrate their consequences.
4. Develop improved in-car instruction and instrumentation to teach driving and perception skills and provide feedback on driver performance.
5. Develop participative classroom units for peer-focused seminars, individual study projects, and group work. These are needed to clarify health and safety values and to enhance personal motivation and social responsibility.
6. Develop instructor training to support the use of new interactive media, participative classroom units, and in-car perception units. The need is to reinvent the teacher and instructor's role, enriching the job by shifting the emphasis from information provider to that of coach or mentor for health and safety motivation, social values, and life skills.

7. Develop tools, models, and instruction units that support parent involvement in young driver education.

8. Develop models and incentives that mobilize community, industry, and government support for coordinating positive influences on novice drivers. These should include links between the driver education and health promotion communities and between driver education and insurance providers.

9. Coordinate development of graduated licensing systems with driver education. Move to multi-stage education in the graduated licensing jurisdictions. These driver education formats should also be pilot tested for effectiveness and market acceptance in non-graduated jurisdictions.

Expand the integration of driver education topics into other school subjects, particularly health, community service, and other values-related activities.

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APPENDIX I - METHODS SUGGESTED FOR PERFORMANCE OBJECTIVES

1. MOTIVATION

1.1 Risk tolerance

1.1.1 Justify driving risk aversion in personal value system

1.1.1.1 Clarify personal health, safety, and social values.

CONDITIONS: In preparatory individual research, group development work on clarification questions, and group discussion

STANDARD: Define value systems, describe own values

1.1.1.2 Research and evaluate social and cost consequences

CONDITIONS: In preparatory individual research, interactive study, and group discussion

STANDARD: Evaluate benefits/costs of driving risks, relate them to other risks and benefits, identify social and psychological status of high-risk drivers.

1.1.1.3 Develop rational personal risk preferences

CONDITIONS: In risk-taking (computer or board) game performance with specific feedback and discussion with peers and family members

STANDARD: Demonstrate ability to choose a range of risk strategies, complete a profile of preferred style, and written discussion of it, relate profile to personal values.

1.1.2 Adopt lifetime risk perspective

1.1.2.1 Explore self-esteem and value of future time

CONDITIONS: In individual homework or computer lab interaction and discussion with peers and family members

STANDARD: Demonstrate ability to calculate long-term effects of repeated small risks, express affirmative perceptions of themselves in later life, and value future time.

1.2 Emotion

1.2.1 Demonstrate control over emotional reactions to other road users

1.2.1.1 Analyze emotions and their potential effects on driving decisions

CONDITIONS: In individual homework or computer lab interaction and discussion with peers

STANDARD: Demonstrate ability to describe frustration-aggression hypothesis and other sources of emotion, describe driving strategies for dealing with emotion, relate to other decision situations.

1.2.1.2 Role play control under provocation

CONDITIONS: In group work with peers

STANDARD: Demonstrate ability to recognize internal cues and control responses. Describe how mature control over emotions connects with future plans and personal values.

1.3 Intrinsic motivators

1.3.1 Demonstrate management of personal motivators

1.3.1.1 Discuss implications of stimulus seeking while driving

CONDITIONS: In group discussion with peers

STANDARD: Demonstrate ability to recognize needs for stimulation and to articulate relations to appropriate driving choices.

1.3.1.2 Plan rewards for managing own behavior

CONDITIONS: In individual research, writing, and group work with peers

STANDARD: Produce concrete action plan that recognizes personal value of task mastery, self-esteem growth through self-control/autonomy, resisting adverse pressures, and the value of lifetime learning.

1.4 Resisting negative learning

1.4.1 Resist negative media and commercial pressures

1.4.1.1 Model rational consumer skills

CONDITIONS: In individual research, writing, and group work and role play with peers

STANDARD: Demonstrate ability to describe interests of major stakeholders in highway transportation, entertainment media use of driving imagery, and personal value of resisting adverse pressures.

1.4.2 Resist negative informal pressures

1.4.2.1 Model strategies for resisting adverse pressures

CONDITIONS: In individual study, group discussion, and role playing with peers

STANDARD: List and discuss ways roadway system forgives and reinforces poor driving and negative peer influences, express self-efficacy to resist pressures inimical to their own interests.

2. KNOWLEDGE

2.1 Becoming a driver

2.1.1 Recognize how novices differ from experienced drivers

2.1.1.1 Create practice plan and maintain driving log

CONDITIONS: In individual research, writing, and group work with peers

STANDARD: Demonstrate ability to describe drivers' learning curve and self-tests that can be used to determine proficiency, and explain the effect of an unskilled driver on other highway users.

2.1.2 Describe basic driving tasks

2.1.2.1 Outline simplified driver model

CONDITIONS: In individual research, writing, and interactive study

STANDARD: Demonstrate ability to understand the full range of abilities and motivations needed for responsible driving.

2.1.3 Internalize reasons for regulation of driving behavior

2.1.3.1 Review rules of the road, signs, signals, and markings

2.1.3.2 Review licensing requirements

CONDITIONS: In individual research, writing, interactive study, and group discussion with peers

STANDARD: Demonstrate knowledge of rules, signs, signals, and markings; and ability to understand the process, rationale, and social necessity of traffic regulation.

2.2 Human factors

2.2.1 Recognize capacities and the range of individual differences/limitations in drivers

2.2.1.1 Describe range of variation in fundamental abilities underlying different drivers' skills and performance

CONDITIONS: In individual research, writing, interactive study, and group discussion with peers

STANDARD: Demonstrate understanding of relevant human capacities and limitations, reasons for variation in reaction times, and sources of error in basic driving tasks.

2.2.2 Summarize individual needs/drives

2.2.2.1 Describe the attitudes of society towards cars and driving

CONDITIONS: In individual research, interactive study, and group discussion with peers

STANDARD: Demonstrate ability to analyze societal impacts of vehicles

2.2.2.2 Discuss personal motivations to drive

CONDITIONS: In group discussion with peers

STANDARD: Demonstrate ability to analyze how motives will change over stages of life and how motives will change in different situations.

2.2.3 Appraise importance of expectancy in highway system operation

2.2.3.1 Analyze road users' expectancies and consequences of violating other drivers' expectancies

CONDITIONS: In individual research, interactive study, and group discussion with peers

STANDARD: Demonstrate ability to restate the importance of expectancy.

2.2.4 Contrast impaired and unimpaired performance

2.2.4.1 Understand influences of alcohol, drugs, fatigue, and illness

CONDITIONS: In individual research, interactive study, and group discussion with peers

STANDARD: Demonstrate ability to classify sources of impairment, identify consequences, and integrate understanding of impairments with knowledge of driving tasks.

2.2.5 Recognize assumptions made about drivers in highway design and operation

2.2.5.1 Research human factors of traffic and highway engineering

CONDITIONS: In individual research, interactive study, and group discussion with peers

STANDARD: Demonstrate ability to identify limits of highway engineering, possible design/maintenance errors, restate meaning of design speed, define perception-reaction-braking distance, define sight lines and distances, identify differences among highway types.

2.2.6 Recognize needs of cyclists/pedestrians

2.2.6.1 Analyze traffic interactions from their viewpoint

CONDITIONS: In individual research, interactive study, and group work

STANDARD: Demonstrate ability to calculate dynamics of their movements and identify the range of individual differences and limitations.

2.2.6.2 Discuss personal errors as cyclist/pedestrian

CONDITIONS: In group discussion with peers

STANDARD: Demonstrate ability to identify with and express consideration for more vulnerable road users.

2.3 Physics

2.3.1 Assess potential of car to permit evasive maneuvers

2.3.1.1 Answer a series of questions about the basic physics of mass and velocity as they relate to automobile performance and crash dynamics

CONDITIONS: Individual research, interactive study of drawings, photographs, computer graphics, or interactive videos

STANDARDS: Demonstrate ability to identify the trajectory of the automobile, the speed at which the vehicle will exceed its envelope of control, and any activities which will help the vehicle successfully complete its maneuvers.

2.3.1.2 Sort representations of road surfaces into rank order from most traction to least traction

CONDITION: Individual research, interactive study of drawings with descriptors, photographs, videotape presentations, computer graphic images, interactive videodisc images

STANDARD: Demonstrate knowledge of friction on dry road surfaces, damp road surfaces, wet road surfaces, oily road surfaces, and icy road surfaces. Rank order must be correct.

2.3.1.3 Locate stopping distances under various road surface conditions

2.3.1.4 Locate point of brake application prior to entering a curve under various road surface conditions

CONDITION: Interactive study of [pictorial options above] and the view from an automobile travelling at a given speed

STANDARD: Demonstrate ability to judge braking distances without error.

2.3.1.5 Sort the driving characteristics of conventional and anti-lock brake systems into two sets

CONDITION: Given a list of driving characteristics for each kind of system

STANDARD: No errors.

2.3.2 Describe relation of speed to crash energy

2.3.2.1 Research occupant, pedestrian, cyclist, ejected victim injury mechanisms

CONDITIONS: In individual research, interactive study, and group work

STANDARD: Demonstrate ability to define injury tolerance, identify injury mechanisms, relate crash energy to basics of injury biomechanics.

3. ATTENTION

3.1 Alertness

3.1.1 Recognize effects of impaired states on alertness

3.1.1.1 Analyze states that can affect alertness

CONDITIONS: In individual research, interactive study, and group work

STANDARD: Demonstrate ability to define alertness and effects of alcohol, drugs, transient mental states, and fatigue.

3.1.1.2 Identify valid measures for avoiding fatigue effects

CONDITIONS: In individual research, interactive study, and group work

STANDARD: Demonstrate ability to define and recognize symptoms of fatigue, assess effects of fatigue, criticize folk remedies for driver alertness, and list remedies.

3.2 Dividing Attention

3.2.1 Self-monitor division of attention over task components

3.2.1.1 Practice divided attention performance

CONDITIONS: In individual research, interactive study and games, part-task simulation, and driving

STANDARD: Demonstrate ability to define division of attention, identify spatial and category distribution needs, identify effects of distractors, maintain performance on divided attention tasks, narrate and report self-monitoring of attention targets and weightings.

3.3 Switching Attention

3.3.1 Model effective switching

3.3.1.1 Practice and feedback to maintain switching

CONDITIONS: In individual research, interactive study, part-task simulation, and driving

STANDARD: Demonstrate ability to define benefits of two- second switching rate, narrate switching, and identify situations that impede switching, causes of attentional tunnel, and strategies for avoiding attention capture.

4. DETECTION

4.1 Visual Scanning

4.1.1 Model mature scanning patterns under all conditions

4.1.1.1 Practice fixating and reporting appropriate targets on periphery and horizon

CONDITIONS: In individual research, interactive study, and part-task simulation with through-windshield and side-mirror display and a pointing capability

STANDARDS: Student must correctly prescribe the scanning pattern and also state frequency of the scanning performance. 80% of the targets must be detected when first presented, remaining 20% must be detected before entering hazardous zone.

4.1.2 Demonstrate potential hazard detection

4.1.2.1 Practice detecting a series of randomly presented signals

CONDITIONS: Interactive study of visual display (static or dynamic) through the windshield and side and rear view mirror scenes and a set of signals inserted into those scenes

STANDARDS: Demonstrate ability to detect signals on the horizon, partly obstructed and visible through rain, fog, and snow. 80% of the signals must be detected within an acceptable time frame.

4.1.2.2 Identify signals in an out-of-windshield view which are potential or actual hazards

CONDITIONS: Interactive study of visual display (static or dynamic) through the windshield and side and rear view mirror scenes. Potential hazards of different task will be inserted throughout the scenes

STANDARDS: All targets must be identified.

4.2 Detecting Potential Path Deviations

4.2.1 Detect vehicle weave and yaw with peripheral vision

4.2.1.1 Practice tracking control via peripheral vision

CONDITIONS: Given a film or video presentation, requiring focus on a central vigilance task, from inside a car looking out as the car moves down a road. The car will periodically veer out of its lane and drift during curves

STANDARDS: Student must detect each instance of path deviations progressively earlier until central task is no longer affected.

4.2.1.2 Maintain precise lane position control and low steering rate in actual vehicle through a series of standard road maneuvers, including low, medium, and high speed curves

CONDITIONS: In individual research, interactive study, and actual vehicle under close supervision and divided visual task demand

STANDARDS: Demonstrate no dangerous deviations, straight tracking even under divided attention requirements, narrate distant scanning center, maintain lane position straight, maintain lane position on curve, discuss effects of visual fixation on steering and speed control.

4.2.2 Demonstrate "gut feel" sensitivity for yaw and incipient loss of control

4.2.2.1 Discriminate changes in surface texture and friction underway

CONDITIONS: In individual research, interactive study, part-task simulation, and driving on slippery surfaces

STANDARD: Demonstrate ability to describe cues for skid detection, identify incipient side slip, narrate road surface feel.

5. PERCEPTION

5.1 Seeing with understanding

5.1.1 Appreciate limitations of perception

5.1.1.1 List perceptual failures as potential factors in crashes

CONDITIONS: In individual research, interactive study, and group work

STANDARD: Demonstrate ability to define "looked but failed to see," obstruction and visual noise, and describe weather, time-of-day and road conditions that affect perception.

5.1.1.2 Plan demonstration of expectancy effects

CONDITIONS: In individual research, interactive study, and group work and discussion

STANDARD: Demonstrate ability to define expectancy, discuss expectancy effects, restate "We see what we expect to see based on experience."

5.1.2 Demonstrate early identification of objects near roadway

5.1.2.1 Narrate distant target identification while driving normally

CONDITIONS: In supervised driving with feedback

STANDARD: Demonstrate ability to list targets to be identified, identify targets 10-12 seconds ahead, and maintain performance under divided-attention workload.

5.2 Potential hazard recognition

5.2.1 Demonstrate mature recognition of hazards while driving

5.2.1.1 Report potential hazard recognition

CONDITIONS: In interactive study, given a set of photographs of traffic scenes, half of which have hazards present and half of which do not

STANDARD: Demonstrate ability to identify all potential hazards.

5.2.1.2 Identify potential hazards during driving narrative

CONDITIONS: In individual research, interactive study, traffic with a trained observer/trainer

STANDARD: Demonstrate ability to identify all potential hazard targets, describe effects of inexperience on hazard recognition, and recognize relative risk presented by moving and stationary objects.

6. EVALUATION

6.1 Risk assessment

6.1.1 Recognize effects of age and experience on risk assessment

6.1.1.1 Discuss reasons for novice drivers' under- and over-estimates of risk

CONDITIONS: In individual research, interactive study, and group work and discussion

STANDARD: Demonstrate ability to evaluate reasons for risk judgments and errors, interactions of inexperience with impaired states and emotions.

6.1.2 Model safe gap acceptance

6.1.2.1 Estimate and verify time to impacts under various conditions

CONDITIONS: In individual research, interactive study, and group work

STANDARD: Demonstrate ability to define safe gap acceptance, discuss effects of frustration on gap acceptance, estimate time to completion of maneuver in various conditions.

6.1.2.2 Practice safe margins in speed/closing rate/time to impact estimation

CONDITIONS: In interactive study and on road

STANDARD: Demonstrate ability to evaluate safe margins and execute maneuvers as planned in all conditions.

6.1.3 Evaluate high-risk collision contexts

6.1.3.1 Prioritize the contexts, situations, and actions that contribute to crashes

CONDITIONS: In individual research, interactive study, and group work

STANDARD: Demonstrate ability to define crash causation, restate circumstances and actions from crash statistics.

6.1.4 Personal limits in risk assessment

6.1.4.1 Recognize limits of self-appraisal and abilities

CONDITIONS: In individual research, interactive study, and group work

STANDARD: Demonstrate ability to identify causes and effects of underestimating hazards, identify causes and effects of overestimating ability, age/experience effects and possible reasons for them, and analyze reasons for young drivers developing overconfidence.

6.1.4.2 Demonstrate ability to provide running risk commentary

CONDITIONS: In individual research, interactive study, and in an actual vehicle, driving in normal traffic under close supervision

STANDARDS: Demonstrate ability to correctly evaluate all significant risks, effects of inexperience on hazard recognition, and recognize relative risk presented by moving and stationary objects.

6.2 Others Road Users' Expectancy

6.2.1 Demonstrate consideration for others' expectancies

6.2.1.1 Practice evaluating the expectancies of other road users

CONDITIONS: In individual research, interactive study, group discussion, and driving on road

STANDARD: Demonstrate ability to restate the importance of expectancy in safe highway operations, and evaluate what all classes of other users expect from us in various high-risk conditions.

6.3 Attribution bias

6.3.1 Recognize situational contribution to drivers' errors

6.3.1.1 Model generous understanding of other users' errors

CONDITIONS: In individual research, interactive study, group discussion, and driving on road

STANDARD: Demonstrate ability to: restate effects of distractions, emotions, and conditions on other users performance; effects of self-serving bias; define attribution biases; and show insight into negative emotional reactions.

7. DECISION

7.1 Option matching

7.1.1 Recognize choice among optional responses is usually possible

7.1.1.1 Describe optional actions in response to situation evaluations

CONDITIONS: Given a series of both out of windshield and bird's eye view of scenarios with randomly presented situations requiring student driver decisions

STANDARDS: Demonstrate ability to identify all situations requiring decisions and describe the various options open to the driver for each situation; discuss effects of age and experience on access to options.

7.1.1.2 Analyze risk situations and describe countermeasures to reduce those risks

CONDITIONS: Given a series of pictorial out-of-windshield views which will have random placement of hazards, potential hazards and dangerous situations

STANDARDS: All risks must be perceived while countermeasures can still be taken. Described countermeasures must fall with the range of acceptable actions in the judgment of the instructor.

7.2 Response selection

7.2.1 Select optimal response in time-limited and high-pressure situations

7.2.1.1 Describes optimum driver response to a series of driving scenarios

CONDITIONS: In individual research, interactive study given a visual display (videotape, videodisc, film, CD-ROM, or computer generated graphic of driving scenarios), and group discussion

STANDARD: Demonstrate ability to list options in various situations of differing criticality, discuss hazards of failing to take action in critical situations, discuss reasons why many crash-involved drivers do nothing.

7.2.1.2 Narrate reasons for matching options to situations while under way

CONDITIONS: In driving on road with supervision and feedback

STANDARD: Demonstrate ability to make 80% optimum responses and no responses which would result in an crash.

7.3 Risk Acceptance

7.3.1 Justify personal level of risk acceptance

7.3.1.1 Discuss factors that influence individual's risk acceptance

CONDITIONS: In individual research, interactive study, and group discussion

STANDARD: Demonstrate ability to rationally evaluate deliberate risky driving actions, discuss what you get for the risk you take.

7.3.1.2 Recognize and narrate risks being accepted

CONDITIONS: In driving on road with supervision and feedback

STANDARD: Demonstrate ability to relate actual on-road risks to target risk acceptance.

7.4 Retry/abort

7.4.1 Recognize the need to keep trying if first choice response fails

7.4.1.1 Identify hierarchy of responses in various situations

CONDITIONS: In individual research, interactive study, group discussion, and driving on road

STANDARD: Demonstrate ability to discuss reasons why first response may fail, to rehearse hierarchy of alternative responses under simulated pressure.

8. MOTOR SKILL

8.1 Controlling acceleration and speed

8.1.1 Demonstrate accurate throttle control

8.1.1.1 Practice smooth acceleration and steady speed

CONDITIONS: In individual research, interactive study, group discussion, and driving on road

STANDARD: Demonstrate ability to define proper foot position, list benefits of steady speed, display low jerk accelerating from rest and low variation in cruise speed.

8.2 Controlling deceleration

8.2.1 Demonstrate optimal routine deceleration/ braking

8.2.1.1 Practice early deceleration

CONDITIONS: In individual research, interactive study, group discussion, and driving on road

STANDARD: Demonstrate ability to define early deceleration, discuss benefits/hazards of early deceleration, show optimal early deceleration profile.

8.2.1.2 Practice steady light braking and holding stop on different grades

CONDITIONS: In interactive study and driving on road

STANDARD: Demonstrate ability to produce complete and jerk free stops, define optimal uses of parking brake.

8.2.2 Model smooth time-limited braking

8.2.2.1 Practice moderate impact braking

CONDITIONS: In interactive study and driving on road

STANDARD: Demonstrate ability to strike pedal with moderate impact, try out different impact levels, hold steady pressure at moderate levels, and avoid jerk at stop.

8.2.2.2 Practice preventing and evading rear-end impact

CONDITIONS: In individual research, interactive study, group discussion, and driving on range or road

STANDARD: Demonstrate ability to check rear for oncoming vehicles, discuss reasons for rear end collisions, perform evasive maneuvers.

8.2.3 Demonstrate optimal emergency braking control

8.2.3.1 Assume proper seating position

CONDITIONS: In individual research, interactive study, group discussion, and driving on range or road

STANDARD: Demonstrate ability to discuss relationship of position to braking, adjust optimal position in various vehicle configurations.

8.2.3.2 Practice threshold modulation

CONDITIONS: In individual research, interactive study, group discussion, and driving on range or road

STANDARD: Demonstrate ability to define threshold braking, outline reasons for use, describe cues for incipient lockup, maintain near-threshold deceleration to full stop.

8.2.3.3 Practice maximum braking

CONDITIONS: In individual research, interactive study, group work and discussion, and driving on range or road

STANDARD: Demonstrate ability to make high initial impact and hold, demonstrate release and steer, brake and steer in ABS-equipped car, discuss reasons for using/avoiding lockup, review anti-lock brakes.

8.3 Steering

8.3.1 Display full range steering control

8.3.1.1 Assume proper seating and hand position

8.3.1.2 Practice smooth steering control

CONDITIONS: In individual research, interactive study, group discussion, and driving on range or road

STANDARD: Demonstrate ability to discuss relationship of position to steering, adjust optimal position in various vehicle configurations, perform smooth normal steering.

8.3.2 Display steady lane tracking

8.3.2.1 Practice optimal lane position

CONDITIONS: In driving on range or empty road with no divided attention workload

STANDARD: Demonstrate ability to display low position variation, low steering wheel reversal rate.

8.4 Skill integration

8.4.1 Show ability to start, accelerate, turn, back up, and stop smoothly

8.4.1.1 Identify reasons for seeking smoothness in various conditions

CONDITION: Given a set of prescribed maneuvers: accelerating, decelerating, turning, changing lanes, stopping

STANDARD: Demonstrate ability to list the reasons for smooth maneuvers in driving, describe the glass-of-water test.

8.4.1.2 Draw a series of sketches showing the trajectory of a car not following smooth maneuvering guidelines under various road and weather conditions

CONDITIONS: In individual research, interactive study (given a set of drawings of a car and a narrative describing what maneuver the car is about to undertake and the road and weather conditions present)

STANDARD: Sketches should demonstrate an understanding of the relationship of smoothness to vehicle control.

8.4.1.3 Drive predetermined course to standard of smoothness

CONDITIONS: In an automobile accompanied by a teacher/evaluator

STANDARD: Maneuvers must meet acceptable standards of smoothness in acceleration into traffic and from a stop, deceleration in traffic, and both right and left turns.

8.5 Error Correction

8.5.1 Demonstrate or describe skid correction

8.5.1.1 Understand principles of skid control

CONDITIONS: In individual research, interactive study, group work, and discussion

STANDARD: Demonstrate ability to describe appropriate steering response, discuss seating position, discuss alternate steering wheel hand positions, describe reasons for staying off brakes.

8.5.1.2 Select the correct skid control actions in terms of both braking and steering

CONDITIONS: In individual research, interactive study, group work, and discussion

STANDARD: Demonstrate ability to describe controlling skids with each of the following conditions: front wheel drive/conventional power brakes, rear wheel drive/conventional power brakes, front wheel drive/ABS, rear wheel drive/ABS.

8.5.1.3 Keep eyes up and looking in direction of desired travel

CONDITIONS: In interactive study, given a series of out of the windshield views of various skidding scenarios and pointing device to indicate where eye focus should be, anything from making the mark of a pencil on a static graphic or photograph to denoting the point with a mouse or trackball in a computer generated event

STANDARD: Demonstrate ability to identify direction of visual focus under various skid conditions, point of focus must be in the direction of desired travel in all cases.

8.5.1.4 Practice brake release and shift to neutral

CONDITIONS: In interactive study, low-speed driving on range or empty normal road surface

STANDARD: Restate that steering follows eyes, rapid and smooth release of wheels

8.5.1.5 Practice skid detection and recovery

CONDITIONS: In interactive study or special skid-pad driving range

STANDARD: Demonstrate ability to detect incipient skids with "gut reaction" and make appropriate response quickly enough to correct skid.

8.5.1.6 Practice lock and hold brakes when rotated beyond the point of no return

CONDITIONS: In interactive study, low-speed driving on range or empty normal road surface

STANDARD: Demonstrate ability to define point of no return in skid, relate reasons for lock up.

8.5.2 Demonstrate evasion skills

8.5.2.1 Practice basic evasive maneuvers

CONDITIONS: In interactive study, low-speed driving on range or empty normal road surface

STANDARD: Demonstrate ability to recognize critical situations requiring emergency evasion maneuvers and to perform wheels-off-road recovery, head-on collision avoidance, and rear end collision avoidance.

9. SAFETY MARGIN

9.1 Speed Choice

9.1.1 Model speed choice that provides safety margins

9.1.1.1 Analyze effects of travelling speeds on time available for error correction

CONDITIONS: In individual research, interactive study, group work, and discussion

STANDARD: Demonstrate ability to discuss reasons for personal speed choices, outline factors/conditions leading to variation in speed choice.

9.1.1.2 Practice detecting when observing a driven vehicle any unsafe performance in choice of speed in specific contexts and conditions

CONDITIONS: Given a visual display (videotape, videodisc, film, CD-ROM, or computer generated graphic) of a driving scenario

STANDARDS: All unsafe driving maneuvers must be detected.

9.1.1.3 Practice driving an interactive system that provides the user the ability to choose speeds in specific contexts and conditions

CONDITIONS: Given a computer generated (videodisc, CD-ROM, or graphic display) scenario under control of the student

STANDARDS: Student must drive to a predetermined level of criterion performance before interactive scenario completes.

9.1.1.4 Narrate reasons for speed choice under normal traffic conditions.

CONDITIONS: In an actual vehicle under close supervision of a trained driver training instructor

STANDARDS: Performance must be with acceptable standards of both state/provincial law and recognized good driving activity.

9.2 Separation

9.2.1 Maintain safe headways and lateral separations

9.2.1.1 Detect when observing a driven vehicle any unsafe performance in choice separation

CONDITIONS: Given a visual display (videotape, videodisc, film, CD-ROM, or computer-generated graphic) of a driving scenario

STANDARDS: All unsafe driving maneuvers must be detected.

9.2.1.2 Drives an interactive driving performance system which provides the user the ability to choose separation in specific contexts and conditions

CONDITIONS: Interactive study with computer generated (videodisc, CD-ROM, or graphic display) scenario under control of the student

STANDARDS: Student must drive to a predetermined level of criterion performance before scenario completes – identify when own vehicle is too close to vehicle in front; calculate effects of headways on error correction time; discuss implications of short headways.

9.2.1.3 Practice safe separations under normal traffic conditions

CONDITIONS: In an actual vehicle under close supervision of a trained driver training instructor

STANDARDS: Performance must be with acceptable standards of both state/provincial law and recognized good driving activity. Identifies when own vehicle is too close to vehicle in front.

9.2.1.4 Demonstrate proper separations in all conditions

CONDITIONS: Given a set of visual, out-of-the-windshield representations with vehicles in front at varying distances from own vehicle

STANDARDS: All following-too-close instances must be noted. Identifies when own vehicle is too close to vehicle in front.

9.3 Early Response

9.3.1 Avoid delayed response to detected potential hazards

9.3.1.1 Analyze time and distance needed for response

CONDITIONS: In individual research, interactive study (given road conditions, speeds of own and other vehicles, physical characteristics of own vehicle, and other relevant factors)

STANDARD: Demonstrate ability to define reasons for preparatory response timing, compute total time to respond to a road event requiring an evasive maneuver within .5 seconds and must always include the reaction time of the driver.

9.4 Contexts and Conditions

9.4.1 Commit to safe margins in all conditions of distractions, emotions, occasions

9.4.1.1 Analyze situations that lead to compromising margins

CONDITIONS: In individual research, interactive study, group discussion, and role play

STANDARD: Demonstrate ability to define effects of passengers on driving, discuss effects of time pressures on safety margins.

9.4.2 Adapt driving practices to all external conditions

9.4.2.1 Practice adapting to conditions

CONDITIONS: Given a set of visual representations (static or dynamic) of out of windshield scenes with vehicles and objects in varying distances and aspects to own vehicle in a wide range of conditions

STANDARDS: Demonstrate ability to describe whether to stop, slow down, steer to avoid, or continue on track when approaching another vehicle or other object; all decisions must be within acceptable tolerances.

10. RESPONSIBILITY

10.1 Self-monitoring

10.1.1 Monitor the impact of own driving behavior on other road users

10.1.1.1 Differentiate between assertive and aggressive driving

CONDITIONS: In individual research, interactive study, traffic observation, and group discussion

STANDARD: Demonstrate ability to explain cues to use for evaluating performance.

10.1.1.2 Model methods of assessing decisions and actions

CONDITIONS: In individual research, interactive study, group discussion, and role playing

STANDARD: Demonstrate ability to correctly discuss effects of impaired states on self monitoring, practice verbal self-feedback, carry out checklist/feedback exercises with parent/guardian.

10.2 Internal Conditions

10.2.1 Commit to driving straight/sober

10.2.1.1 Develop and apply plans to avoid impaired driving

CONDITIONS: In group research, group discussion, group development work

STANDARD: Express commitment to positive values concerning driving impaired, leadership in avoiding impaired driving, and entering avoidance actions contract.

10.3 Conflict avoidance

10.3.1 Commit to respecting others' safety margins

10.3.1.1 Review and restate the importance of expectancy

CONDITIONS: In individual research, interactive study, and group discussion

STANDARD: Express commitment to predictability.

10.3.2 Commit to conflict/crash avoidance regardless of fault

10.3.2.1 Explore causes, frequency, and consequences of drivers' errors

CONDITIONS: In interactive study and group discussion

STANDARD: Express commitment to the shared responsibility to correct errors, positive helping, and avoiding being dead right; restate social and personal benefits of conflict reduction, relate to personal values.

10.4 Seat belts and child safety seats

10.4.1 Commit to promotion and leadership in restraint use

10.4.1.1 Plan means of influencing friends and family to use restraints

CONDITIONS: In group work and discussion

STANDARD: Demonstrate correct use in car; ability to restate biomechanics benefits of occupant protection; and commitment to select, use, and be a role model for occupant protection.

10.5 Active Caring and Community Leadership

10.5.1 Adopt active commitment to community safety

10.5.1.1 Research opportunities to reduce national/community cost of crashes

CONDITIONS: In interactive study, group work and discussion

STANDARD: Demonstrate ability to discuss personal, social and economic impacts of crashes and commitment to reducing them.

10.5.2 Accept need to be a leader to improve health and safety

10.5.2.1 Organize opportunities to provide safety leadership

CONDITIONS: In interactive study, group work, and discussion

STANDARD: Demonstrate ability to identify ways to provide community service and support community safety programs and commitment to volunteer time to youth/community organization, and "change the world."

10.5.3 Commit to positive role modelling

10.5.3.1 Explore "contagiousness" of errors and of considerate driving

CONDITIONS: In individual research, interactive study, group work, and discussion

STANDARD: Demonstrate appreciation of the power of role models, express self-efficacy for positive contribution and state normative value for other drivers to do the same.

10.6 Communication

10.6.1 Commit to positive and helpful communication on the road

10.6.1.1 Explore impacts of positive and negative communication

CONDITIONS: In interactive study, group work, and discussion

STANDARD: Demonstrate correct use in car; and ability to explain reasons for always signalling, calculate maneuver time and distance, expectancy, eye contact, and commitment to a positive role in communication.

10.6.2 Show readiness to use direction signals and warning flashers

10.6.2.1 Explore implications of signal use

CONDITIONS: In interactive study, group work, and discussion

STANDARD: Demonstrate ability to describe appropriate uses and discuss reasons for use, commitment to precise and appropriate use of signals.

10.7 Energy and environmental conservation

10.7.1 Use less fuel per driver and per unit distance

10.7.1.1 Develop local plan for transportation energy conservation

CONDITIONS: In interactive study, group work and discussion, and driving with feedback

STANDARD: Demonstrate fuel-efficient driving skills and commitment to using them, relate to personal values.

10.7.2 Minimize environmental costs of driving

10.7.2.1 Explore environmental impacts of driving

CONDITIONS: In interactive study, group work and discussion, driving with feedback

STANDARD: Demonstrate ability to outline environmental costs of vehicle use and life cycle costs of vehicles and components; express commitment to respect equipment and facilities.

APPENDIX II – ACKNOWLEDGEMENTS

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